Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 69 YEARS

August 7, 1943

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Contents

Watt-Hour Meter Compensates Power Transformer Losses 48
W. C. WOODSON, Consolidated Edison Company of New York, Inc.

Aerial Messenger-Cable Installation and Splicing 50
A. C. FORT and J. W. CARVER, Jersey Central Power & Light Company

Plastic Insulations for Conductors. I—Synthetics Not Akin to Rubber 53
E. D. YOUMANS, Okonite Company

A. C. Board Saves Critical Materials 56
C. F. WAGNER, Westinghouse Electric & Manufacturing Company

Substation Control Lines in Fiber Duct 58

Maintenance Practices for Penstocks and Flow Lines 59
JOHN M. SPAULDING, Pacific Gas & Electric Company

Priorities Problems 62

Editorials ..... 47 and 64

Washington Comment 66

News of the Week 67

How 76

Load Servicing 104

New Equipment 112

News About People 122

Manufacturing and Markets 130

Sales Opportunities 134

Letters to the Editor 136

Rural Allotments 139

Book Reviews 142

Index of Advertisements 144

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330 West 42nd Street, New York, 18, N. Y.
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From .....

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To .....

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Signed .....

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TO EXPEDITE SHIPMENT OF WIRES *and* CABLES

Three conductor V. C. Cable with lead sheath.

Do:

. . . order your wire requirements as far in advance as possible so that manufacture of your material can be planned in our production schedule.

. . . consult with government engineers to check with their requirements before purchasing cable for a *government financed project.*

. . . try, wherever possible, to use designs of cable that are available in stock or the simplest to make.

. . . avoid complicated splices and fittings. Your Okonite representative can tell you how to simplify installations.

. . . supply us with cutting lengths promptly as we cannot start manufacture, in most cases, until we have this information.

don't:

. . . specify cables that are unnecessarily complicated. Each operation on a cable requires special machines, any one of which may be cause of delay. Keep your cable design simple. Consult your Okonite representative as to how you can do this.

. . . order short lengths of many sizes. Standardization on a few sizes almost always results in lower cost per foot and much quicker delivery.

. . . send your order in without specifying conditions of installation, supplying properly certified allotment number or symbol and Army, Navy or other government contract number—if any. This information is necessary before your order can be included in our production schedule.

OKONITE is able to supply many types of electrical wires and cables subject, of course, to War Production Board limitations. If you need insulated electrical conductors, get in touch with your nearest Okonite representative; he can help you in many ways . . . The Okonite Co., Passaic, N. J.

3384

OKONITE

Electrical Wires and Cables

IN CASE OF FIRE CALL GraybaR

for FAST-ACTING EMERGENCY SUPPLY SERVICE . . . call on Graybar's Utility Supply-Corps

Fires, floods, windstorms, and other emergencies which interrupt power transmission or distribution are important "test-cases" of GRAYBAR service.

Recently, for example, a fire made it necessary to install new cable to feed an important plant making bomber parts. Yet supplies in the area were "out," and a serious delay seemed inevitable.

The local GRAYBAR representative, however, was able to locate an acceptable alternate on hand at a truck manufacturing plant only thirty miles away. Electrical service was restored overnight.

Similarly, pole lines damaged by recent floods were more quickly restored, as GRAYBAR moved in new poles, hardware and wire from points outside the flood zone.

Technical understanding of your needs, "know-how" on priority and transport, and a network of warehouses stocked to make the most of limited supplies—all these factors work for you "via GRAYBAR".

Many electric service companies keep closely in touch with GRAYBAR on supply stocks *all the time* to assure fast aid should emergencies strike. Is yours one of them?

Executive Offices: GRAYBAR BUILDING New York 17, N. Y.

GraybaR

IN OVER 80 PRINCIPAL CITIES

GraybaR Since 1869 Everything Electrical . . . THAT IT TAKES TO WIN!

WHAT'S BACK OF THE MONOGRAM—IN TURBINES!

A MARK OF AMERICAN INDUSTRY AT ITS BEST

THE answer is DEPENDABLE POWER—smooth, quiet, economical, reliable POWER to drive anything from a pump to a generator.

That monogram implies a background in turbine development going back to the beginning of the century. The progenitors of today's Elliott turbines first took shape almost forty years ago. Even then they were good units—some of them are still in service.

Elliott turbines today have advanced to their present standard of excellence through a process of conservative development. The result is turbines whose engineering integrity builds confidence in every user.

When you need turbines—either as units with their generators, or for mechanical drive—talk it over with Elliott.

Steam Turbine Department
JEANNETTE, PA.
DISTRICT OFFICES IN ALL PRINCIPAL CITIES

ARMY E NAVY
ARMY E NAVY

The Army-Navy "E" has been awarded to both the Jeannette and the Ridgway plants of Elliott Company.

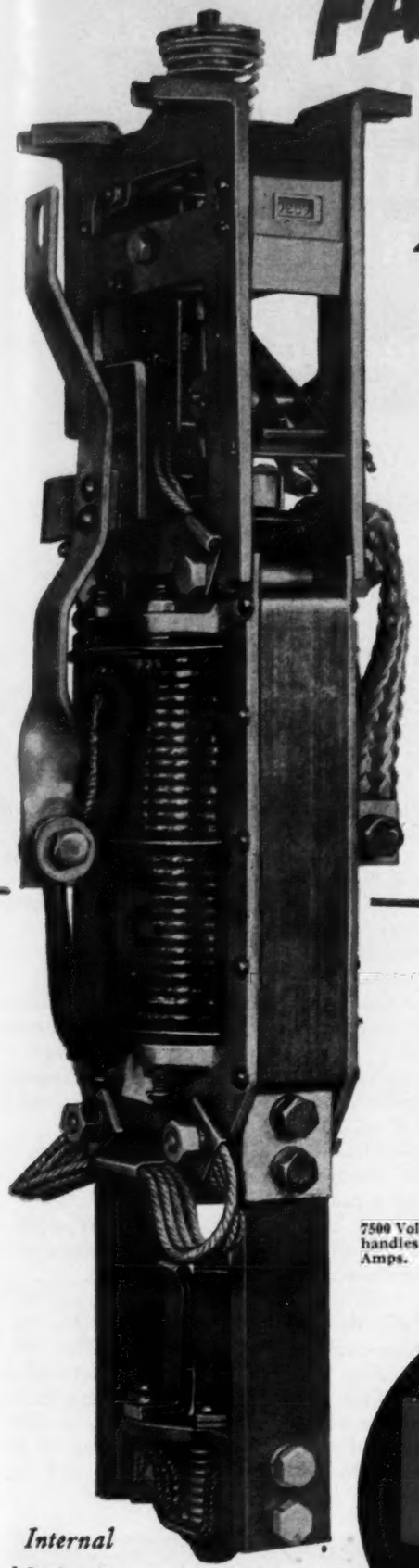
H-673A

ELLIOTT Company

CHECK the FACTS

NEW EQUIPMENT
Improves Distribution

1. Less outages.
2. Saves sectionalizing fuse outages.
3. Trouble confined to faulted phase.
4. Reduces long-time outages.
5. Permits increased application of sectionalizing fuses.
6. Fewer burned-down wires and reduction of attendant live wire hazards.



Internal Mechanism

In Service

This half cycle, high speed SHORT CIRCUITER **reduces the line voltage to zero during faults—extinguishes the arc, saves fuses, forces quick tripping—thereby improving distribution service.**

7500 Volts, 25 to 200 Amps. handles faults up to 5000 Amps.

R&IE

SHORTING CONTACTOR

The Check List

- CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS
- DISCONNECTING SWITCHES INDOOR AND OUTDOOR
- AIR BREAK SWITCHES
- INTERRUPTER SWITCHES
- CUTOUTS AND THERMO-RUPTERS
- SWITCH OPERATING MECHANISMS
- SUBSTATIONS
- OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES
- IRK INTERLOCK SYSTEMS
- AUTOMATIC SECTIONALIZING EQUIPMENT
- METAL CUBICLES
- TESTING DEVICES

AILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.

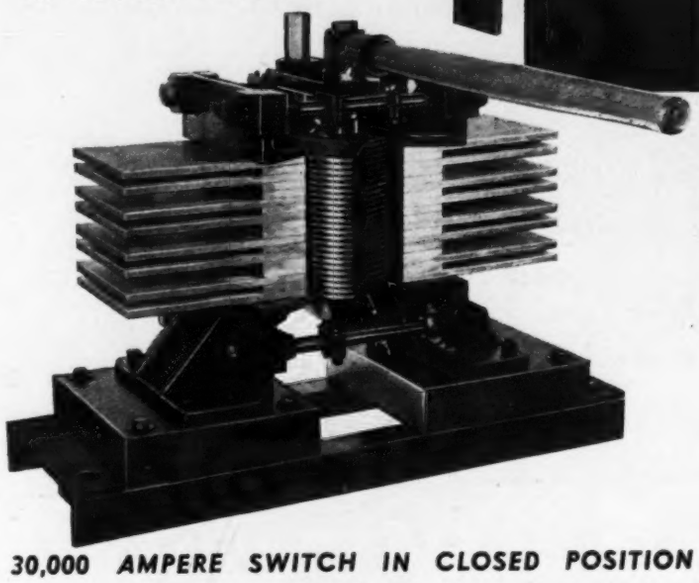
N CANADA—EASTERN POWER DEVICES, LIMITED, TORONTO

HEAVY AMPERE SWITCHES

Designed to Handle

THE NEW REQUIREMENTS OF PRESENT DAY *Production*

6000 AMPERE SWITCH IN CLOSED POSITION



30,000 AMPERE SWITCH IN CLOSED POSITION

The Organization BEHIND THE PRODUCT

The Electrical Engineers Equipment Company, an organization of engineers, as well as manufacturers, has specialized in the manufacture of high voltage switches, heavy ampere specialties, and protective equipment for more than thirty years. Excellence of design, extra built-in value, economy of performance characterize every "Three E" product. "Three E" specialists have all worked in the field and have had long and close contact with operating problems as concerns the application of line and station equipment.

Some time ago this organization was called upon to develop a line of switches from 6000 to and including 30,000 ampere capacity to meet the new requirements of war and associated equipment production. Specifications for the 30,000 ampere switch were that it had to be designed so that it would close as well as open the 30,000 amperes with not more than 10 volt potential difference across the switch in open position. Also, the 30,000 amperes were to be carried continuously without any undue rise in temperature. Quite a number of these switches are now in service. Their performance is such that this type switch is now a standard "Three E" product.

We are prepared to furnish these switches in capacities of 5,000 to 50,000 amperes, modified and so designed to fit all individual installations. This entire range of amperes can be met with the same unit design by the addition of more members of the same units.

Write for complete details.

The contacts are designed so that they will automatically advance and seat on new points to assure clean and perfect contact surfaces. Therefore, any reasonable amount of wear and burning which takes place when heavy ampere switches are opened will not unduly limit the service life of this switch.

No weight to lift! No effort wasted! The switch blades are pivoted in the center allowing all the manual effort to be applied to contact pressure of the switch contacts.

The switch is of portable type with mounting adjustment to compensate for unevenness and sloping of floor.

A large number of butted joint contacts make possible streamlined current flow, keeping heat losses at a minimum.

Each unit of the blade as well as each unit bar of the clip carry their proper share of the total amount of current in the switch.

Two individual switch bases are used so that there will be full unobstructed air flow to the switch contacts. This means the switch will run cooler. Also, there is less critical material used.

The switch is so designed that the strain or load of the contact pressure is entirely taken up by insulated tie rods from switch clip to switch clip, so as to be fully neutralized as well as self-contained.

ELECTRICAL ENGINEERS EQUIPMENT CO.
MELROSE PARK ILLINOIS

Advertising Dept., OHIO BRASS COMPANY
MANSFIELD, OHIO

Please send me Bulletin No. 770-H describing the O-B Line Post.

NAME .....

POSITION .....

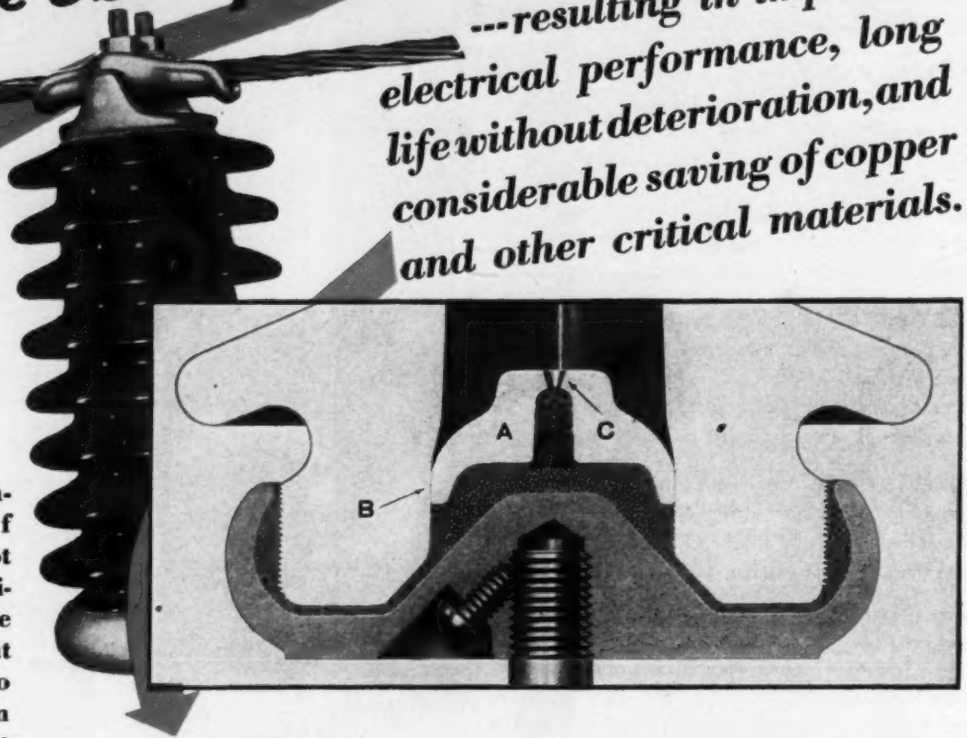
ADDRESS .....

COMPLETE DESCRIPTION OF O-B LINE POSTS AND CATALOG INFORMATION IS AVAILABLE ON REQUEST

Only IN THE O-B LINE POST

Can You Get the *Clamptop* and *Ceramic* Seal

---resulting in improved electrical performance, long life without deterioration, and considerable saving of copper and other critical materials.



THE CLAMPTOP---

Three important advantages accrue to users of Clamptops. (1) Use of hot line tools is greatly facilitated. (2) Many feet of pure copper tie wire are saved at each insulator. (3) Radio interference resulting from conductor attachment methods is eliminated. Clamptops are easy to install and improve the looks of the O-B Line Post whose good appearance is often some factor in its selection.

THE CERAMIC SEAL---Interior of a Line Post must be totally air-tight. This is accomplished in the O-B design by inserting a porcelain barrier (A) at the time of firing. Barrier and inside of chamber are both coated with glaze which is fluid at maximum firing temperature and allows escape of heated air at (B). Glaze quickly sets as temperature is decreased, and further cooling creates a vacuum in chamber. When cold, a hole (C) is punched in barrier and the vacuum measured; giving positive proof of perfect seal. Chamber is then filled with inert, dry gas and the barrier plugged with cork and sealing compound. No organic, war-critical, or perishable materials are used in the O-B Ceramic Seal, and it performs its function ideally.

KEEP BUYING WAR BONDS

Ohio Brass

MANSFIELD, OHIO

CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

2417-H

HERE'S A WARTIME INVESTMENT
NEW ELECTRO-COOLER THAT JUMPS
POWER TRANSFORMERS 20-60%..AND

QUICK FACTS

EASILY INSTALLED or removed — *without* shifting the transformer. If the transformer has standard radiator valves, there is no need even to drain oil on installation!

FACTORY SEALED! No pipe connections or joints to be made in the field. ELECTRO-COOLER is factory-assembled as a unit.

NO GLANDS or stuffing boxes! Oil drips and air bubbles are eliminated. Never any need to fix packing.

ONLY ONE SHAFT! Motor and pump are designed as a complete unit — on one shaft and in one frame. Result: greater mechanical strength, fewer parts, fewer mechanical fits.

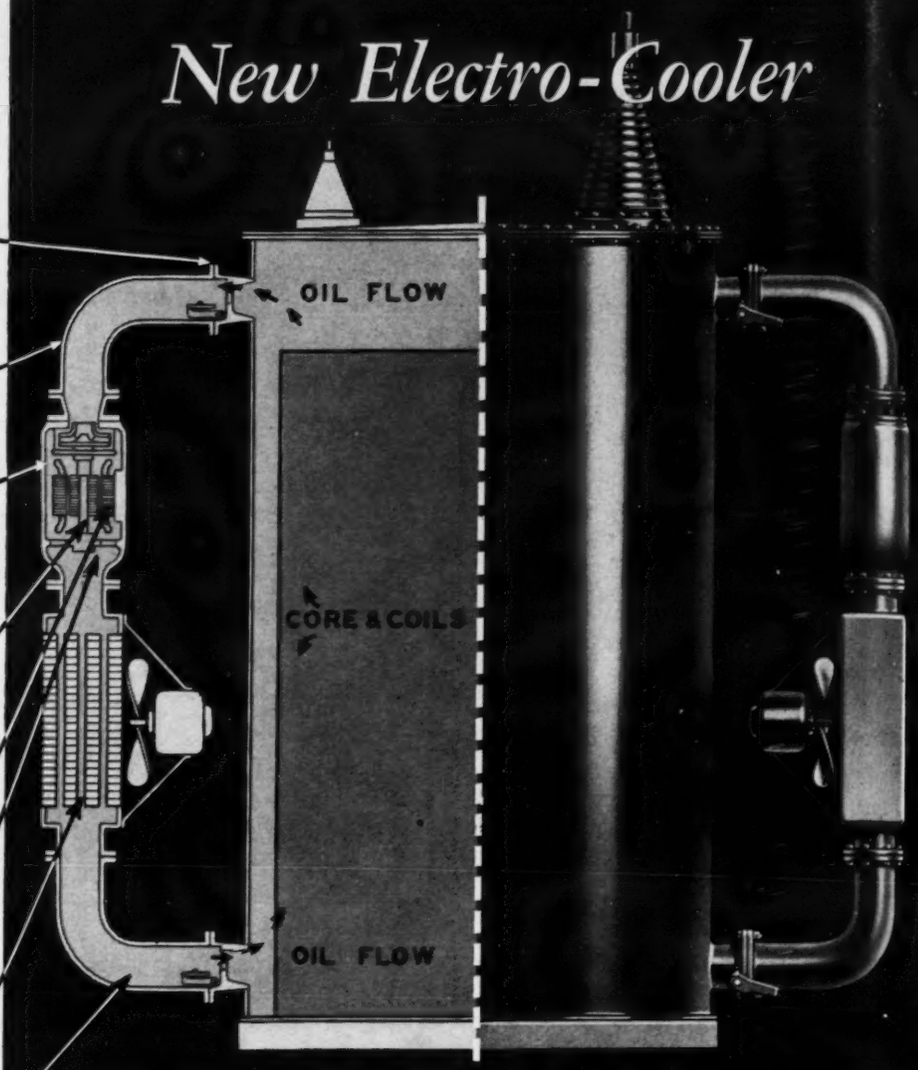
SIMPLICITY! The three-phase squirrel cage motor has no starting brushes, no commutator, nor other such wearing parts to cause trouble.

SELF-LUBRICATED motor and pump are totally enclosed, immersed in oil

HIGH-PRESSURE TESTED! Possibility of oil leaks or seepage is minimized by testing the ELECTRO-COOLER at 50 pounds pressure. Maximum working pressure is only a few pounds.

SELF-CONTAINED and self supporting! The new ELECTRO-COOLER requires no foundations.

New Electro-Cooler



THIS ENTIRELY NEW UNIT SHOULD NOT BE CONFUSED WITH ADAPTATIONS OF AIR-CONDITIONING DEVICES

ALLIS-CHALMERS

NT VITH A GREAT PEACETIME FUTURE:
PS APACITY OF MOST ALLIS-CHALMERS
ND AVES TIME, TROUBLE, SPACE, COST!

★ New ELECTRO-COOLERS can step up capacity of most transformers now in service by 20 to 60%. Installation is simple!

★ Allis-Chalmers' new ELECTRO-COOLER is self-contained and self-supporting... employs no stuffing boxes. Here's the coming thing in forced-oil cooling...a sound long-term investment!

★ New Transformers built with Allis-Chalmers ELECTRO-COOLERS use 25% less copper and steel...cost less!

YOUR power transformers are oled by slow thermo-syphon flow sulating liquid through their radi- —and most of them are—chances hat new ELECTRO-COOLERS can ly increase their capacity!

accelerating liquid flow with action — and by forcing cooling ver radiator surfaces — new TRO-COOLERS step up the capacity st transformers now in service by 60%!

tallation of new ELECTRO-COOLERS mple because the units are self- ined and self-supporting. There's ed to shift transformers.

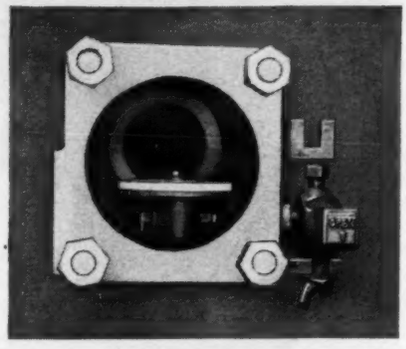
And because the ELECTRO-COOLER is factory-assembled as a unit, there are no pipe connections or joints to be made in the field!

Note that there are no stuffing boxes to require packing — that motor and pump are built on one shaft and in one frame for greater strength and simplicity. Maintenance is *minimum*.

Buying new ELECTRO-COOLERS is smart buying in wartime — and smart buying for the peace years, too. To learn what new ELECTRO-COOLERS can do for *your* system, call the district office near you. ALLIS-CHALMERS MFG. CO., MILWAUKEE, WIS.

A 1577

FINAL TESTING of 20,000 kva transformer equipped with new ELECTRO-COOLERS.



NO NEED to drain oil if transformer has this standard radiator valve!

TRANSFORMERS

ALLIS-CHALMERS MILWAUKEE AC WE WORK FOR VICTORY WE PLAN FOR PEACE

Large Industrial Plants *rely upon* G & W POTHEADS

for full cable protection

Electric cables are important arteries in America's high production effort. The cable ends must be definitely sealed and generously insulated to prevent service interruptions. *G & W POTHEADS* with "Resistoyl" gaskets and properly designed joints prevent the entrance of moisture and the leakage of cable impregnating compound. They are available for all voltages and conductor sizes. Many sizes can be shipped from stock.

Send for

BULLETIN No. 392
Listing over 4000 G & W Potheads

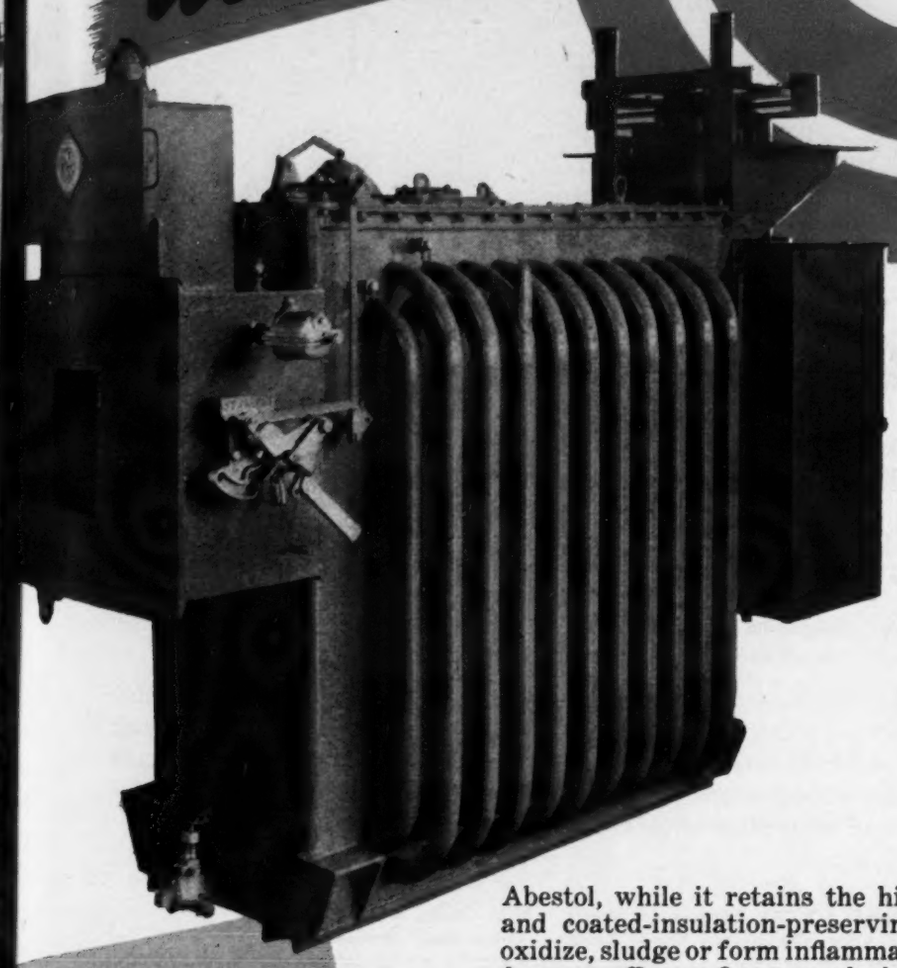
BULLETIN "DIP"
Directions for installing Potheads

G & W ELECTRIC CABLE DEVICES

G & W ELECTRIC SPECIALTY CO.
7780 DANTE AVENUE — CHICAGO, ILLINOIS
IN CANADA—POWERLITE DEVICES, LTD., TORONTO

POTHEADS . . . BOXES . . . OIL FUSE CUTOUTS . . . OIL SWITCHES AND MULTIPLE CIRCUIT OIL DISCONNECTS

Consider these advantages of ABESTOL TRANSFORMERS at load centers!



1 No vault necessary.

2 Substantial savings in secondary copper.

3 Reduced line loss.

4 Less maintenance.

Abestol, while it retains the high dielectric strength, cooling and coated-insulation-preserving properties of oil, does not oxidize, sludge or form inflammable gases. Since Abestol Transformers offer no fire or explosion hazards, they may be placed at load centers with all the advantages such locations permit.

In addition, the inherent self-protection for which AmerTran Transformers have been noted is included. So are high turn-to-turn insulation and coil vacuum impregnation. Rigid core construction, balanced coil design, optimum impedance, these and other features have made AmerTran engineering and construction a standard of excellence for 42 years. American Transformer Company, 178 Emmet St., Newark, N. J.

AMERTRAN

MANUFACTURING SINCE 1901 AT NEWARK N. J.

AMERTRAN

PIONEER MANUFACTURERS OF TRANSFORMERS, REACTORS AND RECTIFIERS FOR ELECTRONICS AND POWER TRANSMISSION

"ALL OUR PLANES RETURNED SAFELY"
"Around Washington bars the gag is that only two kinds of freight now get A-1-a priorities on airplane space from the Far East to the U.S.: 1) generals, 2) mica."
TIME, April 26, 1943

and why not?

Again and again, that thrilling report comes from battlefronts, "All Our Planes Returned Safely."

Today, engines seldom fail because engineers demand quality even in small parts, and go even so far as to specify the maker.

More and more, they specify Macallen-produced mica insulations because their superior effectiveness and dependability have been known for more than fifty years.

Mica varies characteristically according to geographical origin. Some of the most useful comes from India. This A-1-a transportation priority guarantees a continuing supply so that Macallen-made mica specialties may help to make certain that all our planes will return safely; that all our motors will drive tanks, jeeps and PT's efficiently; and that all our electrical devices will continue to function effectively.

PRODUCTS — Compressed Sheets — Mica Paper, Cloth, Tape, Heater Plate, Compressed Sheet Tubing — Commutator Insulation — Compressed Sheet Washers — Insulating Joints and Canopy Insulators — Railway Specialties — Domestic and Imported Raw Mica. *Always specify MACALLEN MICA.*

THE MACALLEN COMPANY

16 MACALLEN STREET BOSTON, MASS.

CHICAGO: 565 West Washington Boulevard CLEVELAND: 1005 Leader Building

HOW TO SOLVE

Operating Problems with *Correct Lubrication*

Be Guided by *Experience!*

IMPORTANT: Over 51% of the major-sized steam turbines in the United States are lubricated by Gargoyle D.T.E. Oils.

EVEN MORE IMPORTANT: Gargoyle D.T.E. Oils have held this position in the steam turbine field for many, many years.

MR. ENGINEER: This is turbine lubricating experience which you *know* you can trust.

MORE FACTS: Gargoyle D.T.E. Oils have proved to be (1) efficient hydraulic media for use in governors (2) dependable lubricants that provide correct lubrication. These oils have a high degree of lubricity plus the stability needed to resist oxidation and formation of deposits under the most severe operating conditions.

Turbine trouble at any time is major trouble—today it would be even more so! Certainly you want the protection of the finest lubricant made. Let *experience* be your guide.

GARGOYLE Lubricants

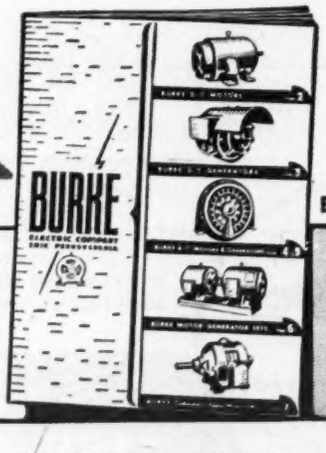
SOCONY-VACUUM OIL COMPANY, INC. — Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. White Eagle Div. • Wadhams Div. • Magnolia Petroleum Company • General Petroleum Corporation of California

USE GARGOYLE D.T.E. OIL

What can BURKE do for Me?

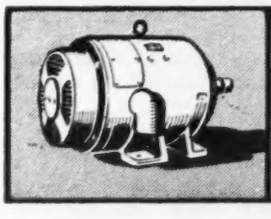
HERE'S a quick look at Burke Products to answer the headline question. When you examine each booklet, more specific questions will develop, questions that Burke engineers will be glad to answer.

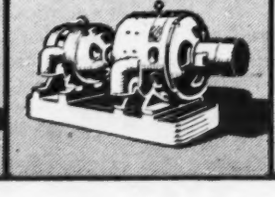
You may be surprised to learn that Burke pioneered and perfected the Universal Motor and the 3-Wire D. C. Generator, that Burke introduced the high cycle Motor Generator Set for powering High-speed Tools, and that Burke was first to use electric welding construction. In order to have you know Burke better we will be glad to send you a complete set of these Burke Bulletins.



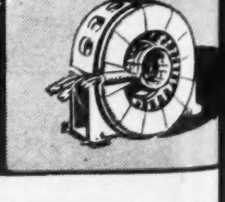
For quick reference to the Burke line, see Sweet's Catalog File and Electrical Buyers' Reference Catalog.

BURKE ELECTRIC COMPANY • 1203 WEST 12TH STREET ERIE, PENNSYLVAN





D.C. Equipment to 1500 H.P. and 1000 K.W.
A.C. Equipment to 1500 H.P. and 1000 K.W.
M-G Sets to 1000 K.W.
Molded Bakelite Terminal Blocks



Meet your RCA TUBE and EQUIPMENT DISTRIBUTOR!

...'Round the Corner Supplier of Electronic Items to War Industry

Need RCA Tubes and other electronic equipment in a hurry?

Need "trade-wise" expediting on important material orders that require intelligent follow-through?

Then get in touch with your nearest RCA Tube and Equipment Distributor today! Filling hurry-up priority orders—often from stock—is his business. If he hasn't got what you need, he'll know where to obtain it as fast as priorities permit. He knows the trade. He knows delivery conditions. Equally important, he knows the technical angles of the equipment that he sells. You'll find his technical help and suggestions invaluable—and these, like his delivery facilities, pertain not only to RCA Tubes and Equipment, but to countless other related electronic items produced by many other manufacturers as well.

✓ TECHNICALLY-INFORMED SERVICE
✓ NORMALLY LARGE STOCKS
✓ FAST DELIVERIES
✓ INTELLIGENT EXPEDITING

There are over 300 of these RCA Distributors throughout the United States to serve you. If you do not already know the one nearest you, a list will gladly be sent on request.

RCA

RCA ELECTRON TUBES

RCA Victor Division, **RADIO CORPORATION OF AMERICA**, Camden, N. J.

Trailing Cables FOR Vital WAR Work

TIREX - rubber sheathed - cables were designed for hard, rough work. They still have remarkable wearing qualities and abrasion resistance and can be depended upon for continuous, dependable performance but, for the duration of the war, they meet restrictions governing the use of rubber, copper and other scarce materials.

It is important, now more than ever before, to get maximum service from trailing cables upon which portable or mobile electrical equipment depends for current. New cables are hard to get and those already in service must be used until they are completely worn out. To this end we make four suggestions.

1. As far as possible use the proper size and type of cable for the work to be done.
2. Provide extra protection or change location where exposure is hazardous.
3. Inspect cables frequently and regularly to discover conditions that may cause trouble.
4. Make repairs promptly when needed.

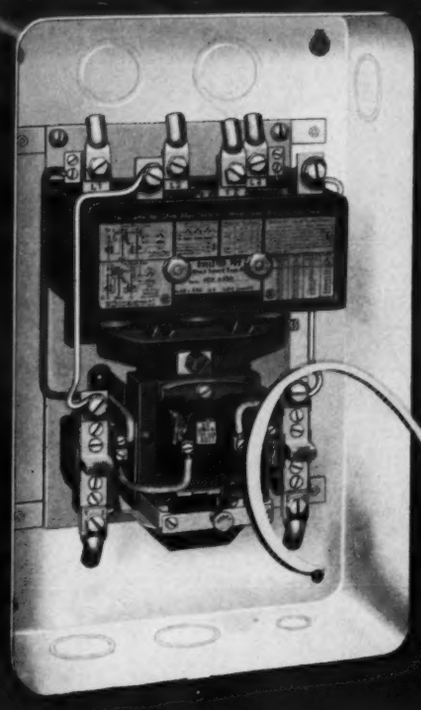
If you must have new cables for vital war work we shall be pleased to do anything we can, consistent with conservation restrictions, to help you get what you need.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

ARMY E NAVY

Simplex WIRES and CABLES

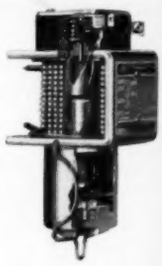
PROTECT YOUR MOTORS
with simple but reliable relays

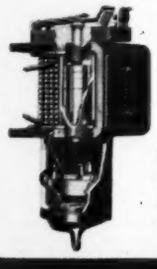


FOR HIGHER CAPACITIES

INDUCTO-THERM TYPE
Cross-section of Bulletin 820 overload relay, adjustable over a wide range of tripping values. Used with the larger motor starters.

COMBINATION MAGNETIC INDUCTO-THERM TYPE
Bulletin 821 overload relay combines advantages of magnetic and inducto-therm relays for high tension starters.





MAGNETIC TYPE
Bulletin 810 overload relay, showing dashpot construction, is ideal where motors are liable to stall.

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
QUALITY

Debunking *Globaloney*

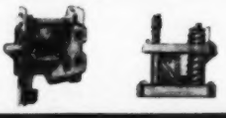
ABOUT "UNIVERSAL" OVERLOAD RELAYS

There is no universal overload relay which will provide complete motor protection under all extremes of temperature found on the globe. A variety of thermal elements is needed for universal overload protection.

Therefore a simple type of relay, like the Allen-Bradley resisto-therm, will satisfy 98% of industrial requirements. Only where a starter is subjected to very wide temperature changes does the universal (compensated) relay offer tangible advantages. Such installations are not an everyday problem . . . hence, the relay with the fewest parts . . . like the A-B resisto-therm . . . is the ideal overload relay.

The following table presents a picture of overload relay performance under various atmospheric temperature conditions. Whether you use resisto-therm or "universal" relays, you must analyze installation conditions and select the correct thermal element for reliable motor protection.

HOW TO SELECT THE OVERLOAD RELAY FOR BEST PROTECTION UNDER VARIOUS TEMPERATURE CONDITIONS

		
Atmospheric temperature at motor	**Atmospheric temperature at starter**	**Relay**
NORMAL	NORMAL	Specify resisto-therm relay because of its simplicity. "Universal" type contributes nothing toward improved protection.
Considerably ABOVE NORMAL (A very common condition)	NORMAL	Specify resisto-therm relay. "Universal" relay may permit motor to reach a dangerous temperature, because it operates on current only and does not consider effect of high atmospheric temperature in which motor is operating.
Considerably BELOW NORMAL	NORMAL	Specify resisto-therm relay because it permits motor to carry any safe load but protects it against overheating. "Universal" relay, operating on current only, will not permit motor to do a wartime job.

ALLEN-BRADLEY

OVERLOAD RELAYS

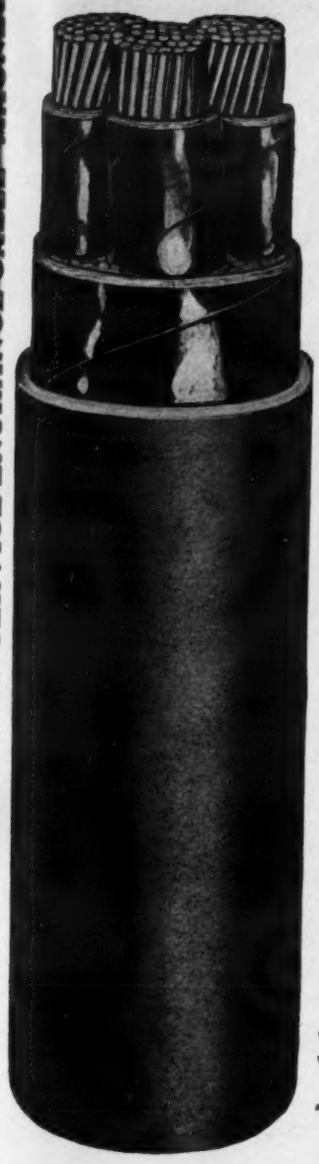
QUALITY

VARNISHED CAMBRIC · RUBBER POWER CABLES · BUILDING WIRE · RADIO WIRES · SIGNAL CABLE · FLEXIBLE CORDS · LEAD-ENCASED AND PARKWAY CABLES · ARMORED CABLE

CRESCENT

Gives You

THE RIGHT CABLE FOR THE RIGHT JOB



For Example,
These Two Among Many

VARNISHED CAMBRIC POWER CABLE

A widely used cable for general industrial power purposes. Varnished Cambric insulation provides higher current carrying capacity for same size of copper conductors.

CRESFLEX NON-METALLIC SHEATHED CABLE

A factory-assembled wiring system that is easily installed at low cost. Especially suitable for war housing, industrial and all interior wiring. Uses no steel or zinc.

WAR PRODUCTION 100%

Crescent Insulated Wire & Cable Co.

CRESCENT
WIRE and CABLE
Factory: TRENTON, N. J.—*Stocks in Principal Cities*

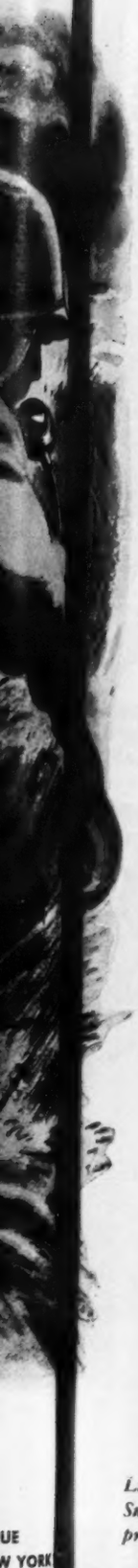
CRESCENT ENDURITE SUPER-AGING INSULATION · WEATHER-PROOF WIRE

WHEN OUNCES FEEL LIKE POUND

*Reg. U. S. Pat. Office

1230 SIXTH AVENUE
ROCKEFELLER CENTER, NEW YORK

UNITED



ASSAULT TROOPS USE LAYTEX*

You know how it is. You slog along all day under full equipment. At first you don't mind the weight very much. But as the hours crawl along, everything you're toting gets heavier and heavier. The canteen you didn't notice in the early stages now weighs as much as your rifle did then. And your rifle feels like a howitzer. Every ounce turns into a pound.

That's why . . . when you're moving fast and the going is tough . . . it's smart to use Laytex Assault Wire.

A full mile of Laytex Assault Wire weighs less than 30 pounds.

Laytex Assault Wire has a breaking strength of 50 pounds per conductor and a talking distance of more than 5 miles.

Laytex resists concussion and a wide range of temperature changes.

It is flexible and waterproof, strong and tough.

Conductors are accurately centered and the weight of insulation and the diameter of the insulated conductor are kept at the minimum.

All this adds up to the fact that one man, wearing a breast reel of Laytex Assault Wire can move swiftly and easily. One man can maintain sure communication with operational headquarters.

Listen to the Philharmonic Symphony program over the CBS network Sunday afternoon, 3:00 to 4:30 E.W.T. Carl Van Doren and a guest star present an interlude of historical significance.

TATES RUBBER COMPANY

1,500,000 POUNDS ON THIS PORCELAIN TEACUP. Base insulators of this type, built to support, on a single point, guyed radio masts as high as 1,040 feet, must withstand a routine proof test of 1,500,000 pounds. In laboratory test they have not failed at 3,000,000 pounds. Mechanical — and electrical — strains of this order are never imposed on transmission insulators; yet the same porcelain, the same engineering talent, the same manufacturing methods go into the least spectacular of Lapp products. Lapp insulators on your lines merit your confidence. Because they are made from *better porcelain*, they are *better insulators*.

Lapp Insulator Co., Inc., LeRoy, N. Y.

ARMY E NAVY

Lapp

Better Porcelain • Better Insulator

When Someone Yells "FIRE!"

WHO MAKES THE NEXT MOVE?

What happens, if fire strikes in your plant?

Who grabs an extinguisher and hits the blaze hard, without panic, without fumbling? Who understands fire-fighting and the weapons with which fires are quickly snuffed out? *How many of your employees know how to handle an extinguisher?*

Fire extinguishers are easy to understand, and the basic facts about fire are simple. The best way to train your workers is by actual *demonstration*. Show them real fires, with extinguishers in action. Stage these demonstrations at your own plant, using your own equipment.

Walter Kidde & Company will send you "How To Teach Fire-Fighting." It tells how to handle demonstrations effectively, how to explain extinguishers and various types of fires. Write now for your own copy. We'll mail it promptly.

Walter Kidde & Company, Inc.
825 Main Street **Belleville, N. J.**

Kidde
PROTECTS LIVES
HIGH PRESSURE GASES · FIRE PROTECTION

TOUGH TEST

You can easily make proves new "extra flex" Fiberglas sleeving is non-fraying

A new sleeving which we have just developed is as flexible as a piece of string and also non-fraying. A buyer of thousands of feet of sleeving was convinced of its flexibility, but skeptical of our non-fraying claims until he applied a tough test of his own, which you can easily duplicate—this way:

Secure from us a sample of new BH extra flexible Fiberglas Sleeving equal in size to the saturated sleeving you now use. Insert the end of a mechanical pencil into the ends of both the new BH extra flexible Fiberglas Sleeving and your present saturated sleeving and push *hard*. BH extra flexible Fiberglas Sleeving will spread slightly *but without breaking*. The usual saturated sleeving will break down at the edges and separate. As an added test, tap the ends of both pieces of sleeving with your finger. Continued manipulation will produce only the slightest fuzz on the BH extra flexible Fiberglas sample, whereas the saturated sleeving will readily unravel and become progressively worse.

NON-FRAYING • FLEXIBLE • HEAT-RESISTANT
NON-INFLAMMABLE • WATER-RESISTANT
NON-CRYSTALLIZING at LOW TEMPERATURES

The new BH extra flexible Fiberglas Sleeving is woven from the choicest continuous-filament Fiberglas yarns. It possesses high dielectric strength, is water-resistant and, like all BH Sleeving and Tubing—is non-inflammable.

All sizes, from No. 20 to 5/8", inclusive, are available. Write for samples of this radically new and different sleeving today—in the sizes you desire. Seeing is believing! Bentley, Harris Manufacturing Co., Dept W, Conshohocken, Pa.

BH PRODUCTS

NON-BURNING IMPREGNATED MAGNETO TUBING • NON-BURNING FLEXIBLE VARNISHED TUBING • SATURATED AND NON-SATURATED SLEEVING

BENTLEY, HARRIS MANUFACTURING CO.
Conshohocken, Penna.

GROTESQUE-LOOKING in their safety suits, these workers are using voltage detector sticks to test high-tension insulators for leakage. Like thousands of others, they are helping to provide America's war plants with a continuous flow of electric power.

To produce the electric power necessary to meet industry's ever-increasing wartime demands requires maximum efficiency from turbo-generating equipment . . . and power plants everywhere are getting top performance from their steam turbines, by lubricating them with *Texaco Regal Oils.*

Texaco Regal Oils rapidly free themselves from air and water, and highly resist oxidation, emulsification and sludge formation, assuring normal bearing temperatures . . . and governors instantly responsive to every load-change.

So effective have Texaco lubricants proved that they are definitely preferred in many important fields, a few of which are listed in the panel.

A Texaco Lubrication Engineer will gladly cooperate in the selection of the most suitable lubricants for your equipment. Just phone the nearest of more than 2300 Texaco distributing points in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

THEY PREFER TEXACO

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated and fueled with Texaco than with any other brand.

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and railroad cars in the U. S. are lubricated with Texaco than with any other brand.

TEXACO

TEXACO Regal Oils

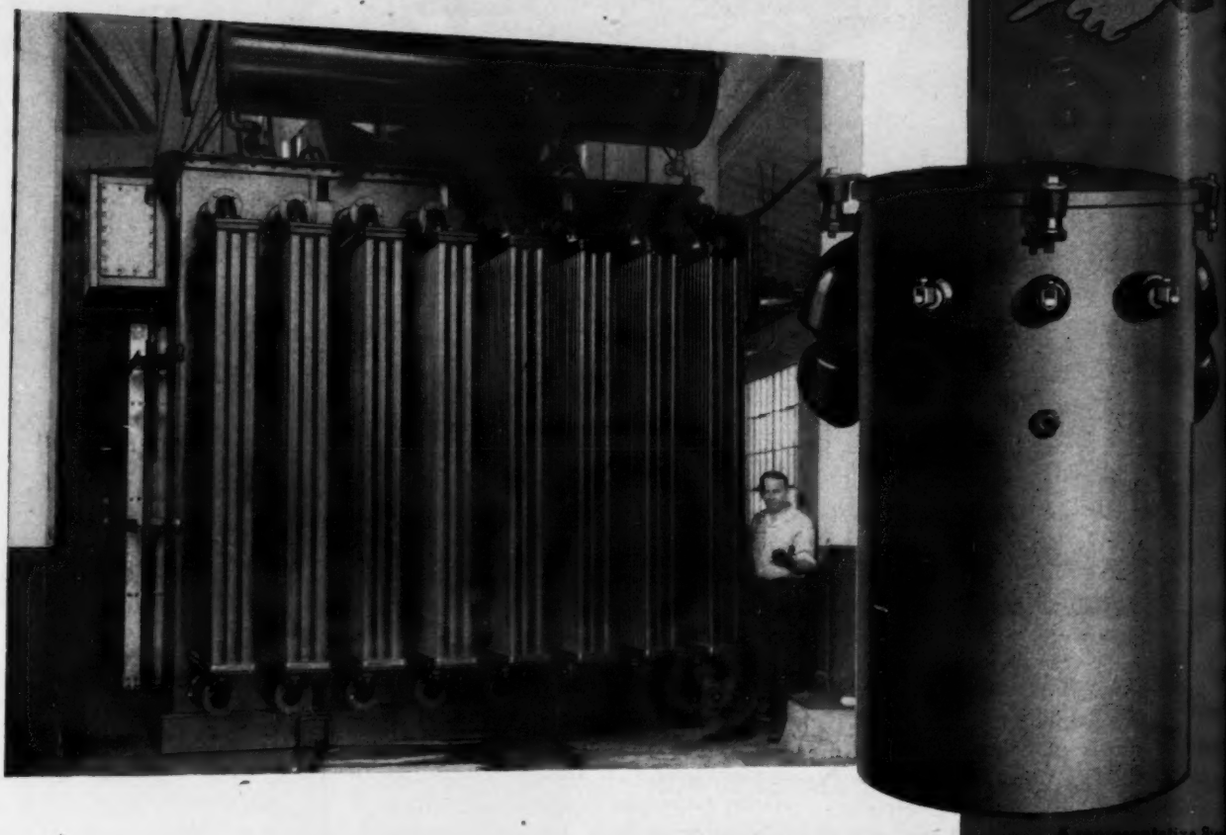
FOR ALL TURBINES

TUNE IN THE TEXACO STAR THEATRE EVERY SUNDAY NIGHT – CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

TRADE MARK

Standard

TRANSFORMERS



A representative Standard Distribution Transformer

Dependability and efficiency in transformer operation comes only when a sound engineering design is reproduced accurately in steel, copper and insulating materials. The pictures on the opposite page show some of the manufacturing operations through which this is accomplished in one typical Standard transformer. Skill, careful workmanship and modern manufacturing practice are combined here to produce transformers that are reliable and economical.

If you want transformers "Engineered to your needs"—call upon Standard. With a capable, experienced engineering staff, a modern, flexible manufacturing set-up and an organization trained to meet urgent production requirements, Standard can deliver the *right* transformers on time!

The illustration above indicates the complete range of sizes made by Standard. From the small unit in the man's hand to 10,000 KVA. sizes, in oil, Pyranol (Askarel) and air-cooled types, Standard transformers *accurately reproduce* our engineer's designs.

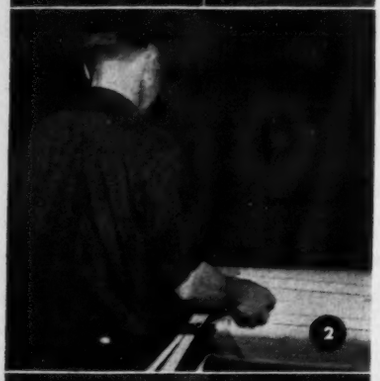
Standard Unit Substations save space, installation time and cost.

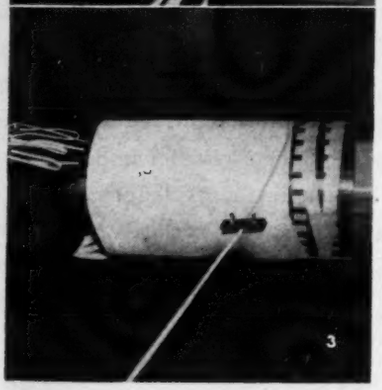
THE STANDARD

built to your specifications

from *Service-proved* designs

STANDARD CONSTRUCTION FEATURES MEAN BETTER SERVICE





1 *Silicon alloy steel of high permeability and low in loss is used for Standard Transformer Cores. It is annealed to relieve rolling strains, treated on both sides with special core plate varnish (which is impervious to hot oil) and sheared to size. Eddy current and other core losses are thus kept to a minimum.*

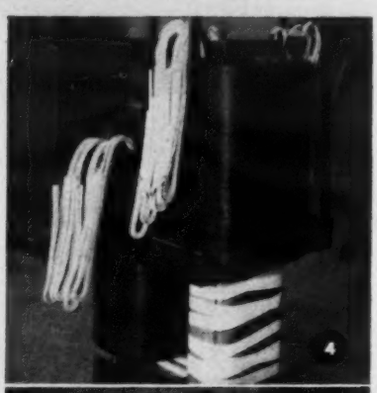
2 *Because the reliability of a transformer is a function of the strength of its insulation, Standard takes special pride in this feature of construction. Exceeding the dielectric test requirements of both the AIEE and NEMA, the insulating materials used by Standard amply protect the coils against flashover, moisture and other hazards.*

3 *This illustration shows high voltage coils, near completion. Note how taps are thoroughly insulated where they are brought out at the left. Shown also are the ends of treated fibre spacers, placed lengthwise in each coil to facilitate the flow of cooling medium between coil layers.*

4 *After the winding is completed, the coils are preheated to 125 degrees Centigrade, vacuum-impregnated with special moisture-resisting varnish and baked. The varnish completely penetrates the insulation, and when baked, forms a weather-proof sheath.*

5 *In building up the core legs, laminations are staggered so that joints at top and bottom of the legs are made by interleaving connection yokes with the laminations to form a butt-lap joint. This gives the core structure great mechanical strength and minimizes the exciting current.*

6 *The sturdy mechanical construction of Standard Transformer coils is shown here. Exceptional care is taken to obtain perfect centering of high voltage coils over the low voltage coils. This is a necessary precaution against a telescoping effect caused by accidental short circuits.*



RANSFORMER COMPANY

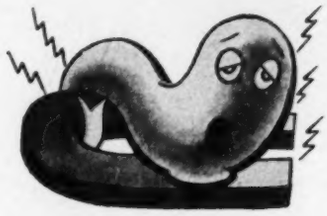
WARREN
OHIO

HOW *PRECIPITRON** WORKS

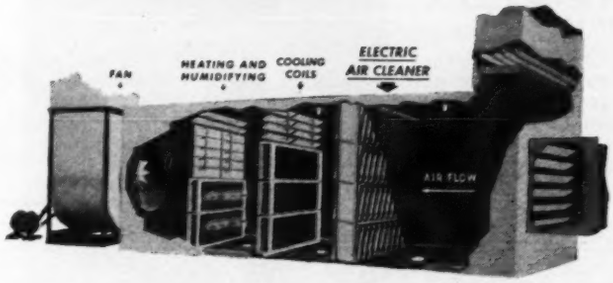
Here's the inside story of *Electric* Air Cleaning

There is really nothing mysterious about Precipitron—the new Westinghouse air cleaner that operates by electricity. Yet it whisks smoke, haze, dust and dirt out of the circulating air as if by magic. In fact, it removes 90% of all particles down to 1/250,000 of an inch in diameter. Even *tobacco smoke,* smallest and most elusive of all air-borne invaders, is quickly "grounded" upon contact with the Precipitron.

Sealed within the ventilating duct so that all air must pass through it, the Precipitron operates silently, efficiently, with no more moving parts than a storage battery. At the front of the unit (or cell), two fine tungsten wires and three grounded rods create a strong electrostatic field. As each particle of dust or smoke passes through this field, it receives a positive charge of electricity, making it a "willing victim" for the next step in the process.



A series of collector plates are located back of the electrostatic field and as the charged particles pass through, they are drawn to the oppositely charged plates where they are deposited and adhere. At regular intervals these plates are cleaned with water and the deposit flushed harmlessly down the drain.



Cross section of typical air conditioning duct.

Today, Precipitron Electric Air Cleaning protects precision parts from air-borne grit and dirt . . . cleans ventilating air for large rotating machinery in steel mills and power stations . . . removes oil mist and welding fumes . . . performs many other important jobs for America's War Industries. For full information on Precipitron and its applications, write Westinghouse Electric & Mfg. Co., Edgewater Park, Cleveland, Ohio

*Trade-mark registered in U. S. A.

Westinghouse Precipitron

PLANTS IN 25 CITIES OFFICES EVERYWHERE

Tune in on John Charles Thomas, Sundays, 2:30 p.m., E.W.T.

Electronics at Work

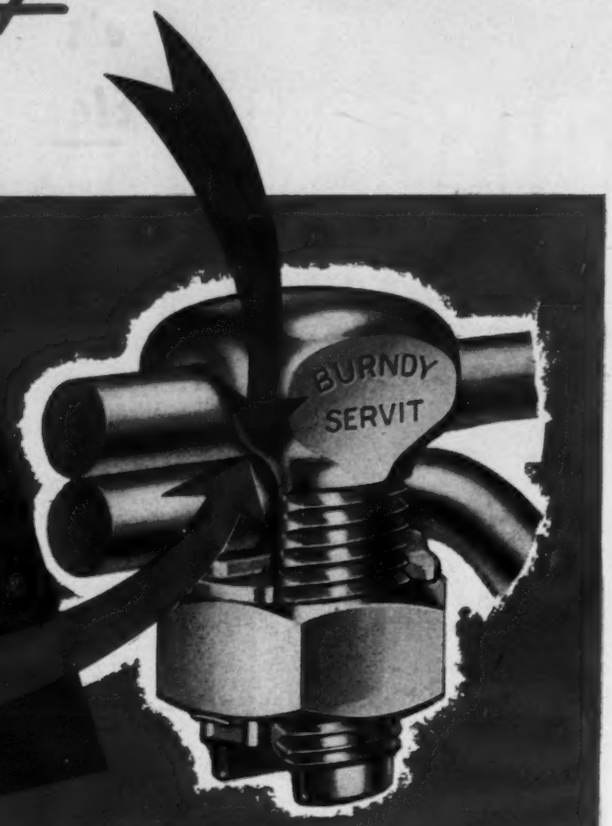
Keeps a firm grip on popularity

because of its *firmer grip* on the conductors!

The Burndy

SERVIT

...gives 50% greater contact pressure here



Pat. No. 20,096

Write for this new illustrated Burndy HYLINE catalog, illustrating the complete line of Burndy indent type connectors . . . including terminals, end-to-end, and separable connectors in all types and for all wire sizes from No. 29 up.

Its broad range of usefulness alone, would put the SERVIT *first* in popularity. But it *keeps* its firm grip on that position because of its *firmer grip* on the conductors . . . providing over 50% greater contact pressure between them.

This *extra* contact pressure results from the use of special high-strength alloys which enable the SERVIT to develop and maintain these high pressures indefinitely. Thus the SERVIT can be used over and over again.

SERVITS are available for conductors from No. 10 wire to 1000 mcm cable . . . with each SERVIT size accommodating a wide range of conductor sizes. Write for illustrated literature.

BURNDY ENGINEERING COMPANY, INC. 107 EASTERN BLVD., NEW YORK 54, N. Y.

BURNDY electrical connectors

Say Goodby to DISCONNECT TROUBLES

HERE'S A

PACIFIC ELECTRIC

Switch with High-Pressure Ribbed-Contacts for Full Conductivity

PRY-OFF SAFETY LATCH FOR EASY OPERATION

THESE Pacific Electric Hook-Operated Disconnects offer trouble-free use for a long life because they are of rugged construction and stay in alignment.

Fitted with high-pressure ribbed-contact surfaces and double blades, you get full conductivity and cool operation. Yet they are easy to operate for you get the pry-off safety latch.

Another thing, easy installation is assured with the mounting holes located where most practical. Terminals are *clamp type* —no soldering needed.

Get all details of their low upkeep on scores of utility lines over the nation—their standard inter-changeable parts, stiff base, spring washers and more features which assure long trouble-free service.

C. H. CUTTER
1015 Securities Bldg.
Seattle, 1, Wash.

G. B. Kirkwood
437 S. Hill St.
Los Angeles, 13, Calif.

J. E. Redmond Co.
448 W. Madison St.
Phoenix, Ariz.

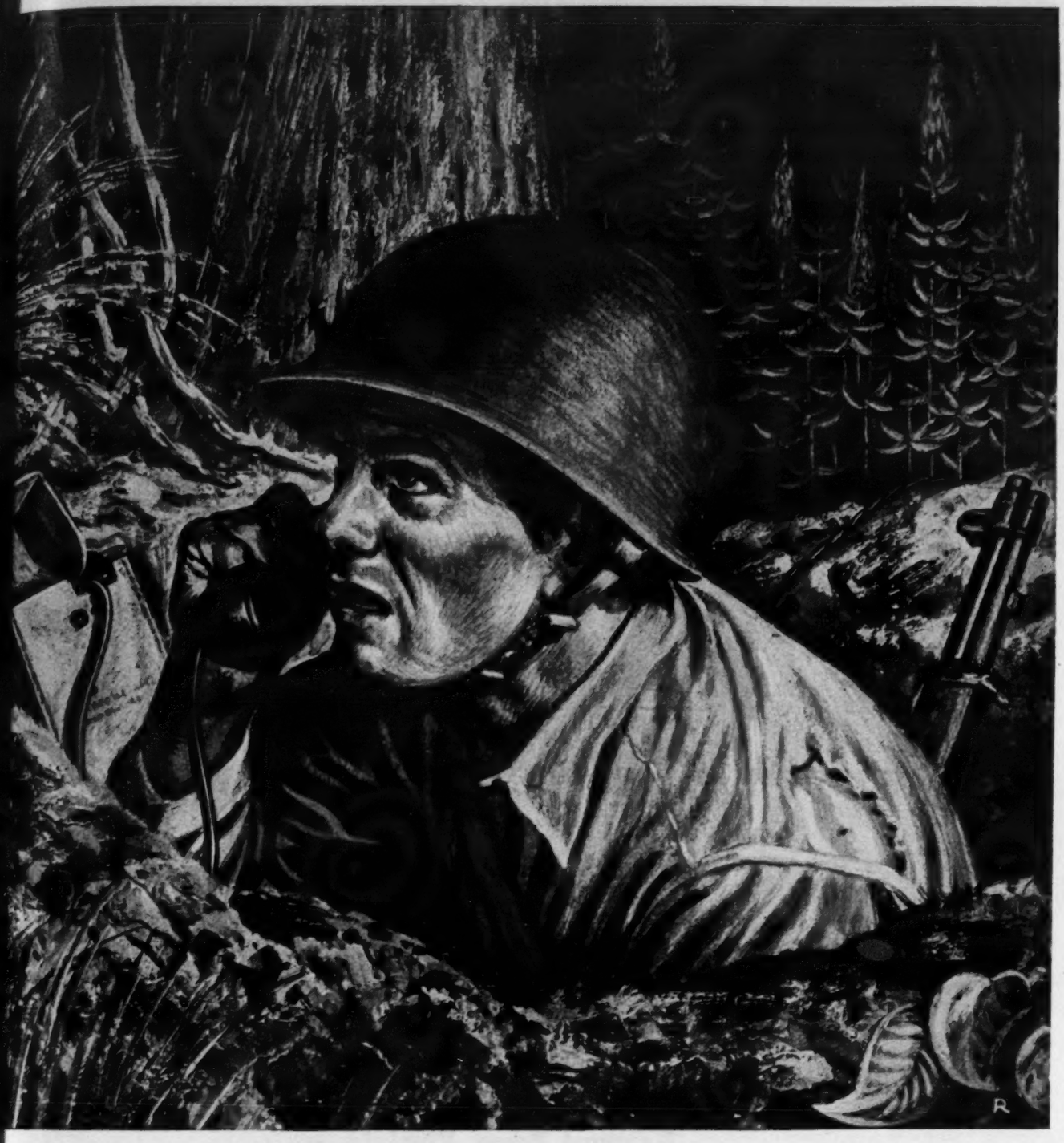
C. C. Musgrove
508 Insurance Bldg.
Dallas, Tex.

Other Representatives in Principal Cities

Pacific Electric Mfg. Corporation

5815 THIRD ST., SAN FRANCISCO, 24, CALIF. DUNES HIGHWAY, GARY, INDIANA

y branch of the Armed Services uses the telephone. No. 5 of a series, Marine Corps.

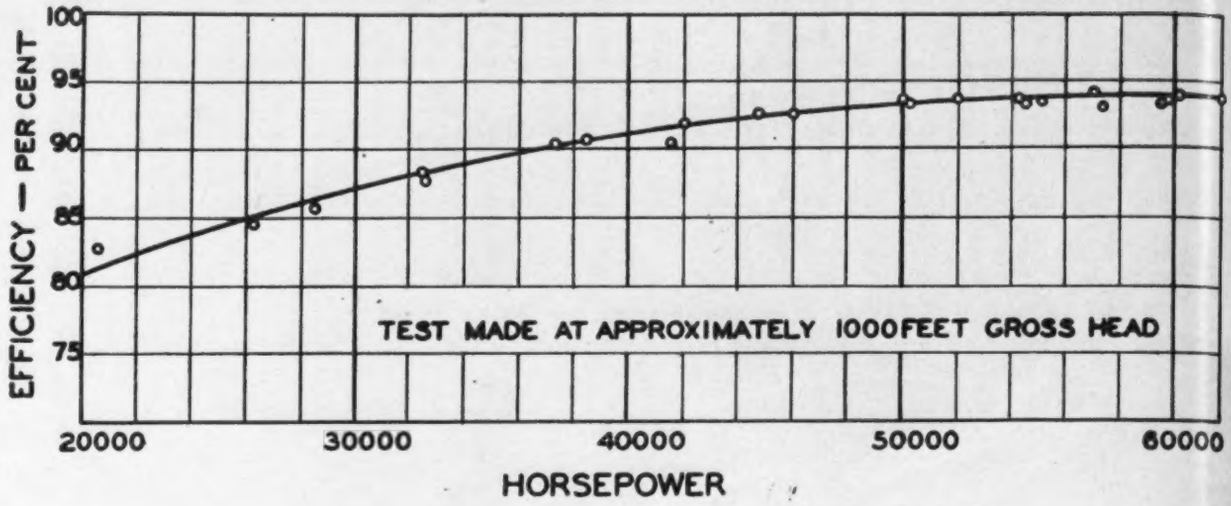


ome day Johnny, front line observer, will climb out of his last foxhole into a world freed from fear dictators. When that day comes, the telephone—now speeding commands on the battlefront and oduction on the home front—will help to place all peoples of the earth on friendly speaking terms.

Western Electric

IN PEACE...SOURCE OF SUPPLY FOR THE BELL SYSTEM.
IN WAR...ARSENAL OF COMMUNICATIONS EQUIPMENT.

ARMY E NAVY



FIELD TEST CURVE

for

60,000 H.P.–925′ NET HEAD–450 R.P.M.

VERTICAL FRANCIS TURBINE

Built by

NEWPORT NEWS SHIPBUILDING AND DRY DOCK COMPANY

HYDRAULIC TURBINE DIVISION

Newport News, Virginia

Our facilities for building turbines, valves, rack rakes, gates, etc., are now in use for constructing ships for the Navy

LIFE ON THE PLASTICS NEWSFRONT

AN ARC-RESISTANT MELMAC*

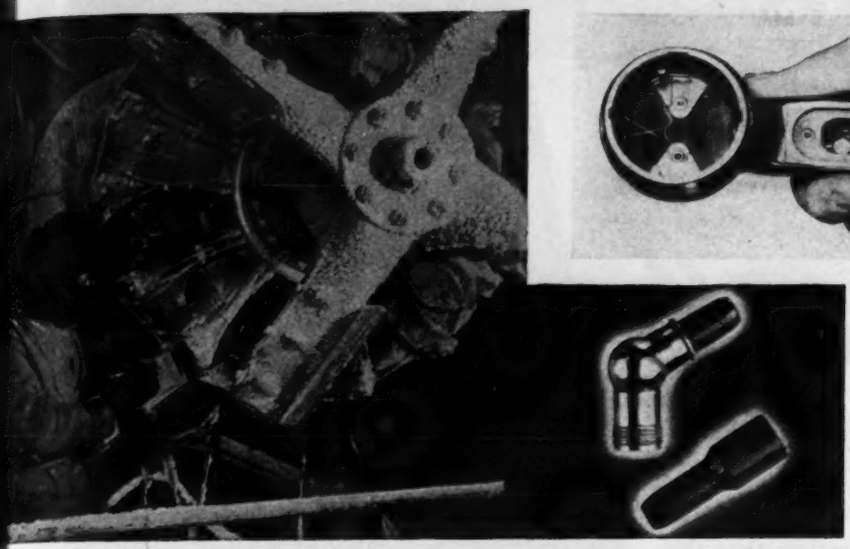
Mineral-filled Melmac 592 offers an unusual combination of electrical and physical properties to meet new needs.

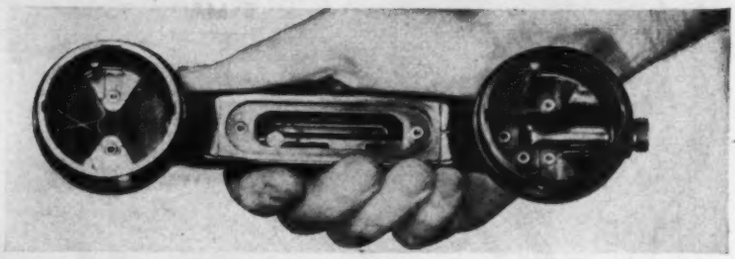
Typical Properties

Dielectric Strength—
430 Volts/Mil.
Arc Resistance—(ASTM)
Avge. 130 Sec.
Heat Resistance—300° F.

Typical Applications

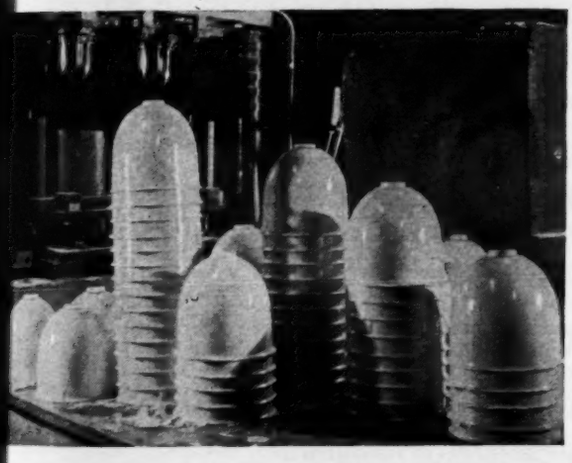
Ignition assemblies, insulation parts, shields, switch plates, cable connector inserts, circuit breakers, and controls.





(*Above*) **BUILT FOR HEAVY DUTY** is this heavy duty hand-set telephone molded for the U.S. Army Signal Corps out of Melmac P-3020—the new shock-resistant plastic for severe service developed in Cyanamid's Research Laboratories. A thermosetting melamine-formaldehyde material, it has a chopped cotton fabric-filler for *high strength*. And in addition, it has the same outstanding characteristics that have contributed to the use of other Melmac plastics in the electrical field. Write us for full information.

(*Above*) **MADE-TO-ORDER WINTER** is produced in this test chamber to study the performance of airplane engines under conditions duplicating the sub-zero temperatures encountered in frigid zones. Resistance to weather extremes plus high dielectric strength, high arc resistance, low moisture absorption and low surface creepage are reasons why Melmac 592 is used for many electrical aircraft applications, such as the harness parts shown.



(*Left*) **NEW STANDARDS** of lighting efficiency have been made practical with the design of light-weight, shatter-resistant BEETLE* Safety Reflectors. In translucent form, BEETLE offers high light diffusion and excellent light transmission that suggests many interesting possibilities for postwar design. This well-known plastic can be molded speedily and economically into a wide variety of styles and shapes. Shown here are reflectors for use on IES type lamps as they come from the molding press.

(*Above*) **ORDERS ARE TRANSMITTED** and received in today's modern warfare via portable "radio jeeps." Weighing less than 10 pounds and almost foolproof in operation, these sturdy transceivers make extensive use of plastic materials. Such recent developments as this point the way to many new electrical applications for plastics in peacetime products of tomorrow.

*Reg. U. S. Pat. Off.

AMERICAN CYANAMID COMPANY · PLASTICS DIVISION · 30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

CYANAMID PLASTICS

BEETLE · MELMAC · URAC · MELURAC · LAMINAC

ANOTHER REASON FOR SPECIFYING

The Monitor THERMALOAD V SOLENOID STARTER

...Prompt Delivery

HERE'S PROOF that the Monitor Thermaload V gives maximum protection at boiler room heat or blizzard cold. Only five second variation in tripping time at 500% overload at temperature extremes that your machines probably will never have to overcome.

That's welcome news to the many who have wanted the positive motor protection that the Monitor Thermaload V assures. The Thermaload V is available from stock—shipped in accordance with existing priority regulations. No longer need your war-busy machines operate without proper safeguard against the hazards of excessive overload; no longer need you search for a "substitute."

It's your move! Now that availability has been added to proved-efficient performance, you can specify the Monitor Thermaload V for original equipment and replacement and be sure that you will get it.

Write manufacturer or your Monitor field engineer for shipping data, technical and installation details.

THE MONITOR THERMALOAD V GIVES YOU THESE FEATURES THAT ASSURE

MAXIMUM PROTECTION

1—Exclusive Monitor Compensated Overload Relay. Ambient temperature does not affect its performance. Tests at —2°F and +136.4°F show only a few second differential in tripping time. The trip always occurs within the same time at a given percentage of overload. 2—Vertical Straight-Line Design. 3—Double-Break, Silver Contacts. 4—Easily-Interchangeable Coils for Different Voltages. 5—Resilient, Shock-Proof Mounting. 6—Tamper-Proof Protection

Available in 1.5 to 7.5 H.P.—110 to 550 Volts (A.C.) and in combination units.

The Monitor Controller Company

GAY, LOMBARD & FREDERICK STS. BALTIMORE-2, MARYLAND

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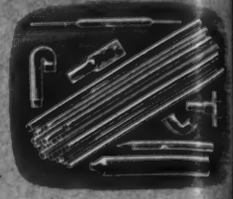

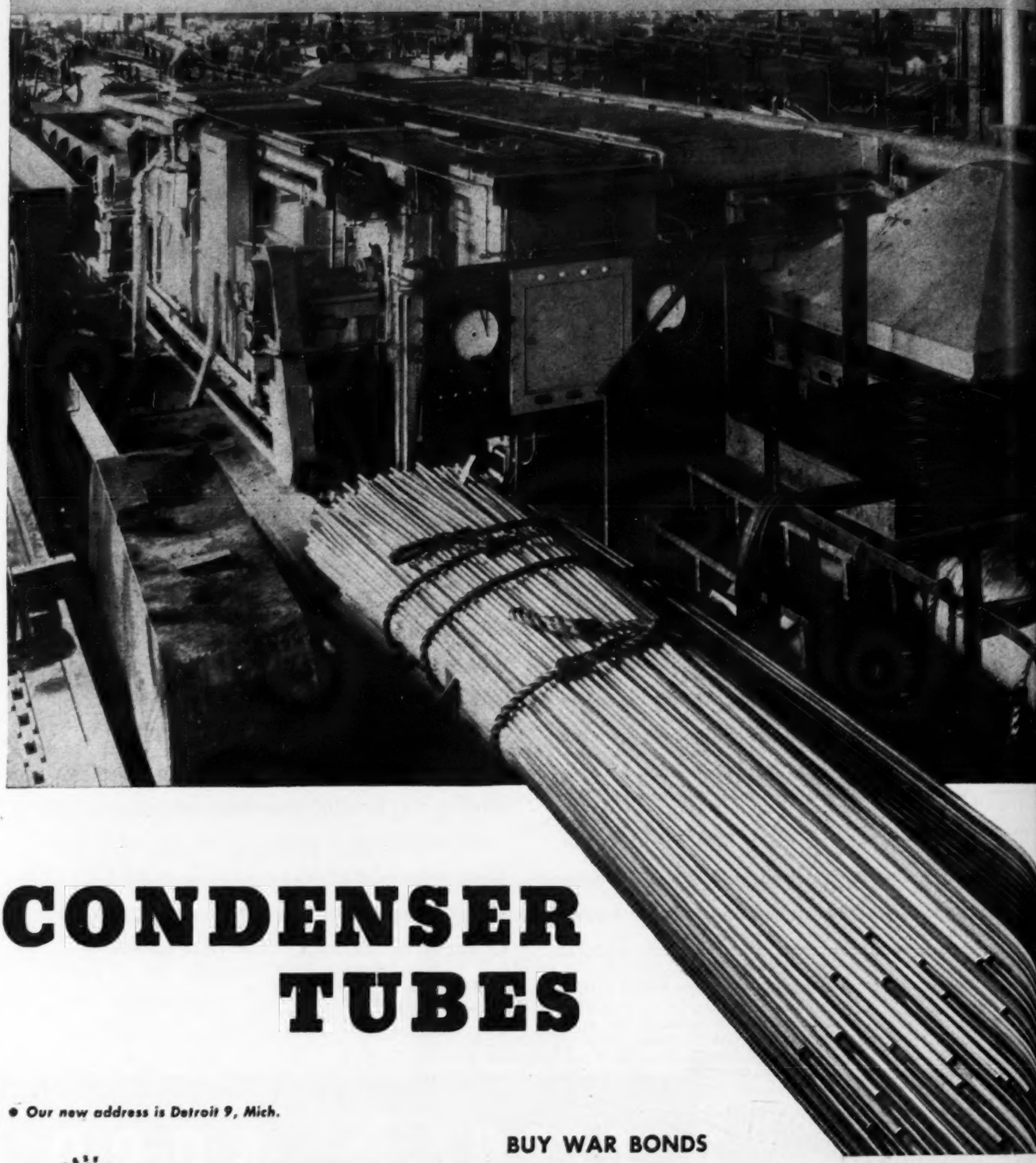

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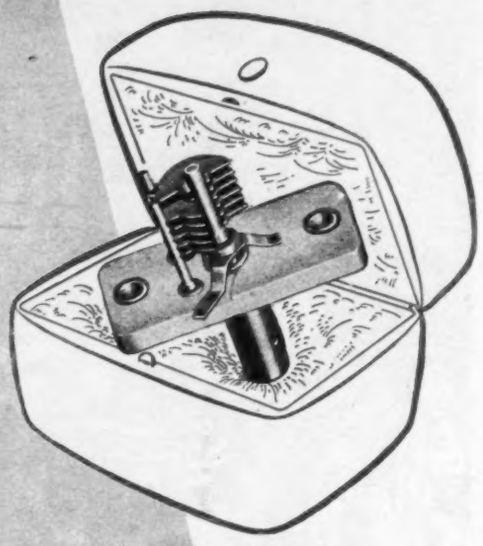

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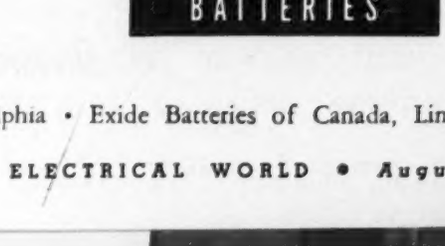

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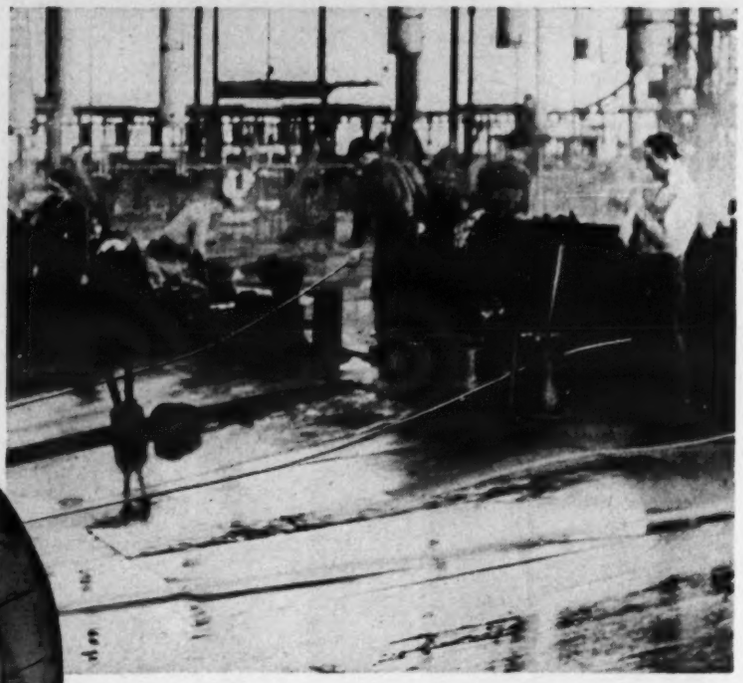

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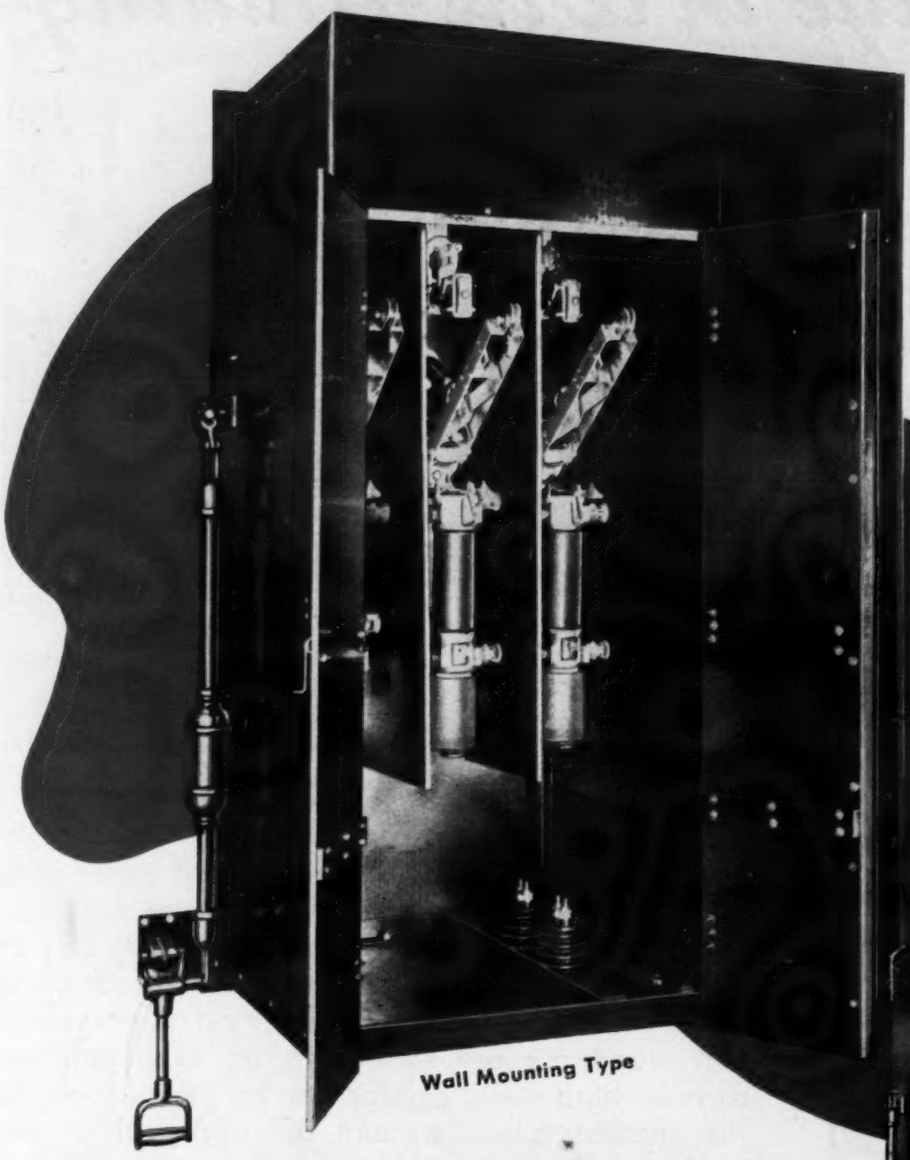
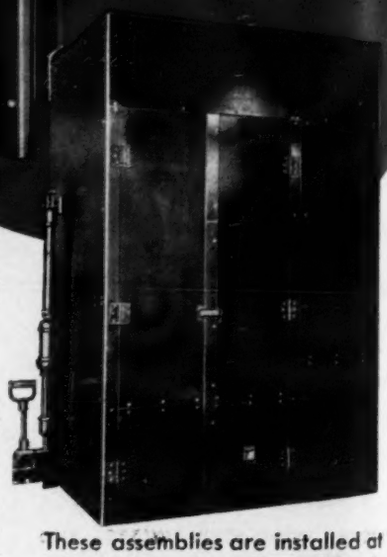


Wall Mounting Type



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Sales Education

There has been a lot of discussion of post-war markets and post-war products, but little is heard about the most difficult problem of all—at least in the immediate post-war period—selling. Who is going to sell, and how?

War is hard on a sales force. With virtually nothing to sell except to one customer, sales forces have been scattered to the four winds. Will the men come back? Some will, but many will find work elsewhere.

This isn't like coming out of the depression, when sales forces could be built back slowly as demand improved and built back with good men. After the war everybody will be hollering for salesmen and there will be no time to lose.

Some of these men will be equipped to carry on immediately, but most of them will not. What are we going to do about it? Is it something the individual employer has to cope with alone, or are there parts of this educational problem at least which can be done through joint effort by an association?

During this war economy interval the relationship between supplier and consumer has been very different from that which normally exists. Will some of these relationships carry over into the peace? Likewise, consumers became accustomed to doing things differently, to getting along with certain substitutes, or with less of this or that. What effect will such methods have on post-war demand and selling.

In other words, is it not impossible that post-war may present brand new sales problems from the standpoint of consumer requirements or attitude? Add these to the problem of a newly recruited sales force and we have something that isn't easy to solve.

Of course all other industries will face the same sort of problem, but since this will be a race against time to satisfy the pent-up civilian demand, it stands to reason that the industry that is best equipped will do the best.

There are some parts of this problem that are common to all concerns in an industry or industry groups, and there are others that are individual. To handle the former will require concerted industry action.

Manufacturers and utilities are facing this post-war problem and, because there is such an interdependence market-wise, attention should also be given to the possibility of joint exploration on the common front. Nor is this the only joint effort. There is the dealer, the contractor and the wholesaler to be considered.

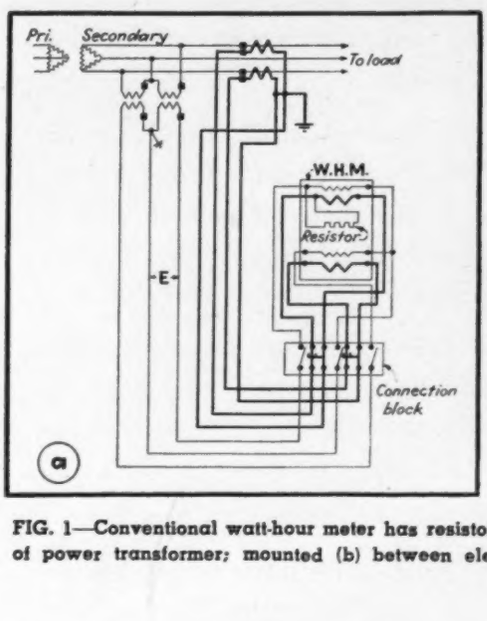
In many communities we have electrical leagues which can be the local focal point. Perhaps we should have more of them. But the education that can be extended to a group ought first to be developed nationally.

At such a time as this the electrical industry misses a common meeting place where intra-industry co-operation could head up.

Watt-Hour Meter Compensates Power Transformer Losses

Wartime conservation abetted in secondary metering by inserting resistor in potential circuit to simulate core losses and tempering calibration curve to compensate for copper losses

W. C. WOODSON,* Consolidated Edison Company of New York, Inc.



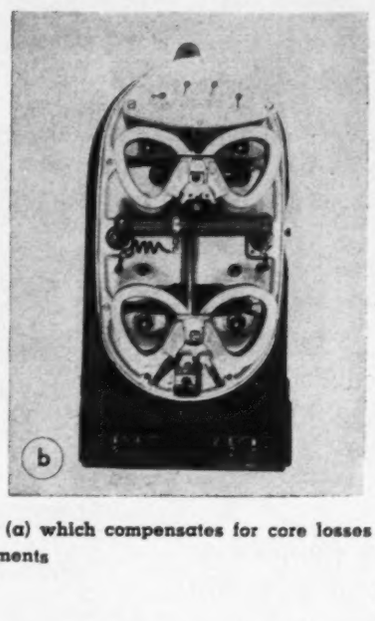


FIG. 1—Conventional watt-hour meter has resistor (a) which compensates for core losses of power transformer; mounted (b) between elements

BY USING a standard watt-hour meter connected to the secondary side of the power transformer bank, but compensated in such a way as to be the equivalent of a primary meter, it will record a measurement of energy representative of the transformer bank losses in addition to measuring the customer's load. The method proposed is new only in that it uses recognized methods in a combination which, to the author's knowledge, heretofore has not been disclosed.

The chief advantage of compensated secondary metering over primary metering is the large reduction in the initial installation and maintenance costs. Also some hazards are removed because of the lower voltage impressed on the metering transformers.

Several schemes have been proposed for measuring the energy input to a power transformer by means of a watt-hour meter connected to the secondary side of the transformer and compensating for the transformer losses by means of auxiliary devices. Probably the most commonly used substitute for primary metering has been a special "compensating" watt-hour meter used in addition to the standard meter. Such compensating watt-hour meters have a copper loss element which has a driving torque proportional to the square of the current. When this element is calibrated, based on the known resistance of the power transformer windings, it will register a value equal to the copper loss in kilowatt-hours. The meter also has a core loss element which has a driving torque proportional to the square of the voltage. When this element is calibrated, based on the known core losses of the power transformer, it will register a value approximately equal to the core loss in kilowatt-hours as these losses are almost proportional to the square of the voltage. The two elements are on one shaft and the combined copper and core losses in kilowatt-hours appear on one register. The calibration of the meter is based upon tests made upon the power transformer to determine the core and copper losses. Such a compensating meter is required in addition to the standard meter used for measuring the customer's load and where coincident demand measurement for several meters is necessary additional impulse wiring and totalizing relays must be installed.

Conventional Meter Compensated

The plan for compensating a standard watt-hour meter, connected on the secondary side of a power transformer, to include a measurement for transformer losses does not require the use of an additional meter.

Compensation for both core loss and copper losses is provided in the method we propose. Core loss compensation (Fig. 1) employs a watt-hour meter connected to the load side of the transformer in the usual manner for three-phase, three-wire secondary metering, but with an additional resistor R connected to the circuit in such a manner that it is energized by the meter voltage E. Watt-hour loss of this resistor is measured by one element of the watt-hour meter. The watt loss is equal to $\frac{E^2}{R}$ and since R is constant, it will vary as the square of E and the measurement will

*Assistant Engineer, Meter Engineering Bureau.

thus proportional to the core ses comparable to the measurement ovided by the core loss element of compensating meter. Since the e losses of the power transformer known, having been previously termined by test, the resistor R y be set at such a value as to oduce a kilowatt-hour registration the meter equal to the total core ses. The setting of the resistor R y be made either in accordance th a watt measurement or a resist- ce measurement as determined m the following general equations:

watt measurement:

$$\text{Watt loss} = \frac{E^2}{R} = \frac{Li \times 1{,}000}{Nv \times Nc}$$

resistance measurement:

$$\text{Resistance} = R = \frac{E^2 \times Nv \times Nc}{Li \times 1{,}000}$$

Where

E = Meter voltage at time of test
Li = Core loss of power transformer in kw. at meter voltage E
Nv = Ratio of voltage transformer
Nc = Ratio of current transformer

Below are three assumed cases rked out for different transformer tings to show the relative value of it should be noted that the pri- ry voltage of the power trans- rmer does not enter in the equa- n:

Power Transformers

otal ting Kva.	Primary Volts	Secondary Volts	Li Core Loss in Kw. at Meter Volts E
500	27,000	2,300	10.580
000	27,000	13,800	33.512
000	132,000	13,800	69.481

Watt-Hour Meter

Nv atio Pot. ans.	Nc Ratio of Cur. Trans.	E Meter Voltage at Time of Test	R In Ohms	Watt Loss in R
/1	240/1	115	6,000	2.204
/1	120/1	115	5,683	2.328
/1	320/1	115	7,309	1.809

$$L_i = \frac{E^2}{E_s^2} \times \text{core loss at known voltage}$$

Where E_s = Voltage at known core loss

Copper Has Compensation

In order to compensate for the pper losses in the power trans- rmer bank, the watt-hour meter is ibrated at full load and at light d in such a manner as to make its rformance curve closely follow the pper loss curve of the power trans- rmer. When calibrated in this nner it will record energy, in ex- s of the secondary load used, by amount approximately equal to

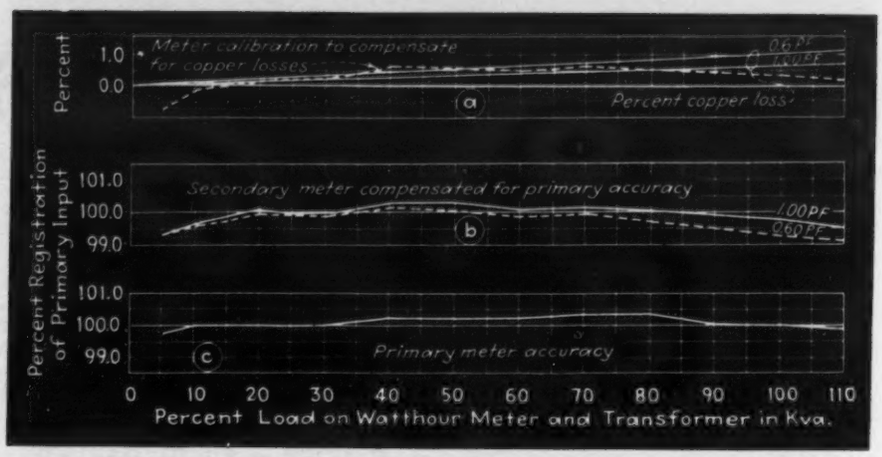


FIG. 2—Primary meter accuracy equaled by meter compensated (1) with resistor and (2) by curve modifications

the copper losses. The copper losses of a power transformer are proportional to the square of the current, and at full load, on a large transformer, will amount to about 0.6 percent of the transformer rating. Copper loss curves at unity and 0.6 load power factor for such a transformer are shown (Fig. 2a), and superimposed on them is an actual performance curve of a watt-meter calibrated to record load plus copper losses. True meter performance (Fig. 2b) in terms of primary input is obtained by plotting the differences between the copper loss curves and the meter calibration curve (Fig. 2a) as departures from 100 percent accuracy. With this calibration the meter will under-record the transformer input slightly at loads below 18 percent and above 80 percent of rating and will over-record slightly at loads between 18 percent and 80 percent of rating at unity power factor load. At other power factors the accuracy will be slightly lower at all loads (dotted curve in Fig. 2b). To simplify the explanation the curves in Fig. 2 have been assumed to be the same for both unity and 0.6 power factor loads. Although this is not entirely true, the small difference which does exist affects all curves equally and would not change the relation among them.

In Fig. 2c is shown the accuracy curve for the same meter calibrated as a primary meter. Registration of the secondary watt-hour meter, in terms of primary input, manifestly varies within very narrow limits of accuracy over a considerable range of load and power factor and is comparable in accuracy to a meter connected in the primary circuit.

In order to calibrate a watt-hour meter in accordance with this proposed method to include core and copper losses, it is proposed to apply a correction, equivalent to these losses, to the standard test meter at time of test (see Fig. 3).

In order to calibrate the meter for

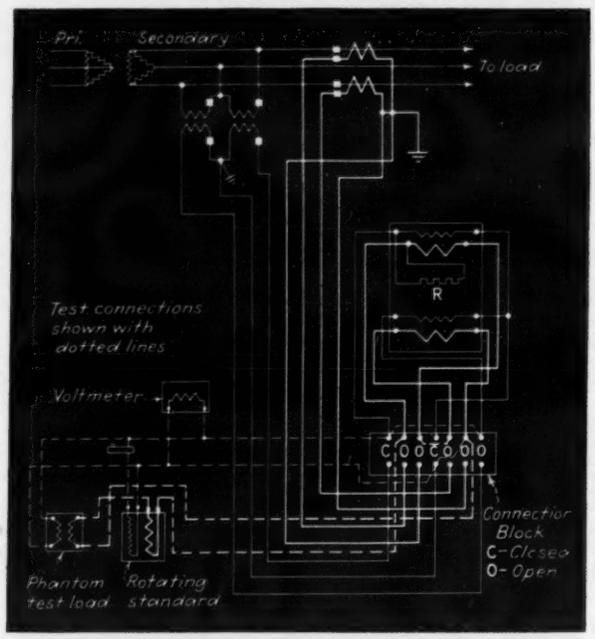


FIG. 3—Test connections for secondary meter compensated to be equivalent of primary meter

operating conditions, the voltage at the meter at the time of test, the ratio of kva. capacity of meter to power transformer, and the power factor for which the compensation is to be applied must be introduced into the calculations. Before the test is started the resistor R is set at its proper value and this setting is thereafter left unchanged.

Calculation of the accuracy in terms of the input to the power transformer is made in the usual manner except that a correction, R_c, is made to the test meter revolutions, R, obtained during the test in order to derive the corrected number of revolutions, R_o. The correction is applied as follows:

$$R_o = R + R_c$$

Where R_o = Corrected number of revolutions of standard test meter
R = Uncorrected number of revolutions of standard test meter
R_c = Correction, in revolutions, of standard test meter

The value of R_c is determined from the following equation:

$$R_c = \frac{1}{2}R\left[\frac{\text{Copper Loss}}{\text{Load}} + \frac{\text{Core Loss}}{\text{Load}}\right]$$

$$= R\left[\frac{\left(\frac{SF}{100}\right)^2 \times L_c}{\frac{SF}{100} \times T\cos\theta} + \frac{100\,KE^2}{FS \times T\cos\theta}\right]$$

$$= \frac{R}{T\cos\theta}\left[\frac{FSLc}{100} + \frac{100\,KE^2}{FS}\right]$$

Where
T = Power transformer rating in kva.
$\cos\theta$ = Power factor of load at which meter is to be calibrated
$F = \dfrac{\text{Power transformer rating in kva.}}{\text{Meter rating in kva.}}$
S = Percent test load on meter in terms of kva.
L_c = Copper loss in kw. at power transformer at 100 percent kva. load
L_i = Core loss in kw. of power transformer at meter voltage E_c
E_c = Meter voltage at which core loss is known (from tests)
E = Average voltage at meter at time of test
$K = \dfrac{L_i}{E_c^2}$

In the above discussion only balanced polyphase voltage and load has been assumed. Very small errors are introduced when the voltage and load are unbalanced. Such errors are negligible as the total transformer losses are such a small percentage of the average transformer load.

Installation, Splicin

Public pride in trees met by installin cable with inbuilt messenger at co only 12 to 20 percent more than tree wir

A. C. FORT and J. W. CARVER,
Jersey Central Power & Light Company, Morristown, N. J.

PEOPLE living in the Northern Division are very proud of their shade trees, with the result that we must contend with very heavy growth of a large number of types and species. Compliance with rules of shade tree commissions and natural desire to co-operate with the aims of the various garden clubs result in an inability to obtain anything even nearly approaching satisfactory tree clearances for our open-wire construction. As a result of our inability to obtain proper clearances, we find that approximately two-thirds of the outages on open-wire distribution lines is caused by tree interference.

Tree wire is satisfactory when used in the vicinity of small limbs, but it is necessary to add wooden guards in the vicinity of medium-sized or large limbs. Labor of threading the three conductors through the trees and attaching the wooden guards is very high, approximately ten man-hours per 100 ft. of line. Ordinary open-wire construction does not have sufficient mechanical strength to withstand the weight of limbs that fall on the lines during ice storms and high velocity winds.

Some trunk lines have from five to ten trees per section, the center line of the trees being within 12 to 36 in. of the center line of the poles, and there are from ten to 30 large limbs growing up through the line. We have long realized that aerial cable construction would answer most of our tree clearance problems and have made several installations of the individual conductor type cable in the past. The type of cable available and used required separate threading through trees and separate pulling of the messenger and the cables. It also required individual reel set-ups for each conductor and messenger. The installation procedure was as follows:

1. Pull in stringing lines.
2. Pull in and sag messenger.
3. Ride cable (in cable chair) and install temporary cable rings.
4. Pull in conductors.
5. Ride cable and affix permanent cable rings.

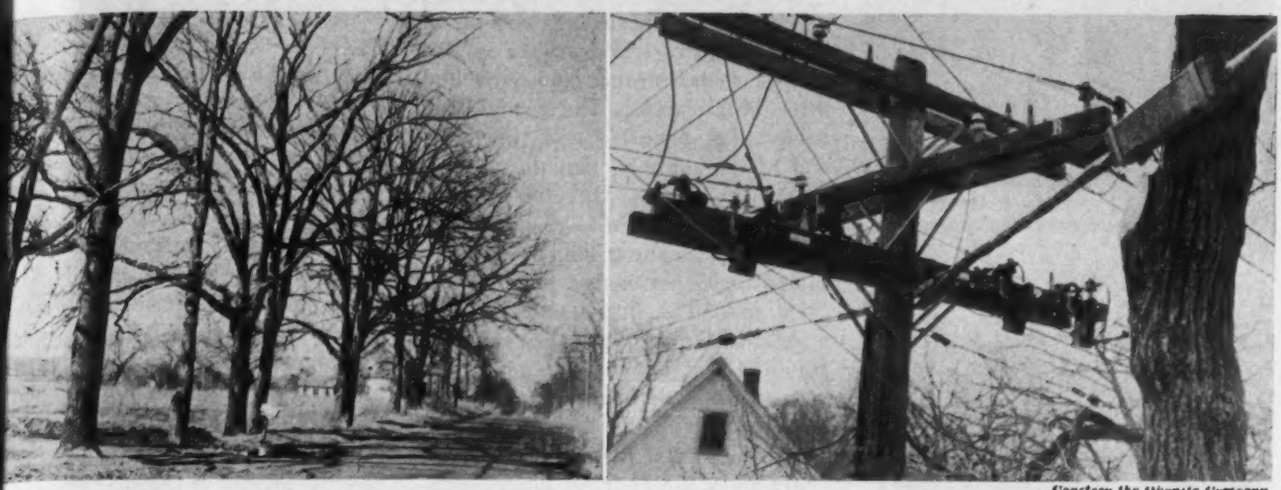
Labor involved in placing aerial cable of the individual conductor type was a considerable proportion of the total installation cost.

Inbuilt Messenger Cable

A cable consisting of three conductors bound at the factory to a Copperweld messenger with a spiraled wrapping of copper tape has recently become available. As the labor of installation would apparently be considerably less than that required for the type formerly used, a trial installation was made.

Size of the conductors was determined in the usual manner. Size of messenger was determined by the allowable sag and the required short-circuit current for phase to ground faults. Where minimum size of messenger required from an electrical standpoint would permit the cable to sag too close to telephone construction, it is usually less expensive to increase the messenger size than to replace the poles with higher poles

Aerial-Messenger Cable



Courtesy the Okonite Company

TREE CONDITIONS met by application of aerial cable (left). Cabl and messenger dead-ended at terminal point (right)

We operate with a multi-grounded neutral that is used for both primary and secondary circuit, using the messenger for the common neutral.

Cost of strengthening the pole line and guying for aerial cable is approximately 25 percent greater than that used for heavy tree-wire construction. Provision was made to attach the messenger close to the top crossarm with standard messenger clamps and reinforcing links.

Individual conductors in the composite cable are insulated with a rubber compound (Okolite), a semi-insulating tape, a copper shielding tape and a colored tape for phase identification. The three conductors are then spiraled together and covered with sisal braid. This group is then attached to the messenger by winding a flat copper strap around the cable and messenger, using a 5-in. lay; 1,000-ft. lengths of cable were wound on each reel, the messenger being cut so that it extended about 10 ft. beyond each end of the cable.

Seven-man Crew

A seven-man line crew, consisting of a foreman, four linemen, a driver, and a groundman, was used to install the cable. The following procedure was employed:

Defective or short-life poles were replaced, all guying installed, all through-bolts and messenger clamps were installed. Running blocks and a pulling line were placed in position for the first 1,100 ft. of line. The messenger clamp through-bolts were used to support the running blocks. The 1,000-ft. reels of cable were transported to the job on a two-wheel pay-out trailer.

The end of the messenger was fed through the end meshes of a Kellems "Grip," so that the grip was around both the cable and messenger. The end of the messenger was then doubled back and fastened to the pulling eye of the grip. The "pull" was thus divided between the messenger and the Kellems grip with the pulling line being attached to the cable and messenger with a ball-bearing swivel. A lineman was in position at each pole as the end of the cable approached the pulling block. He made certain that the messenger was on top of the cable for the entire span and assisted the cable to enter the pulling block.

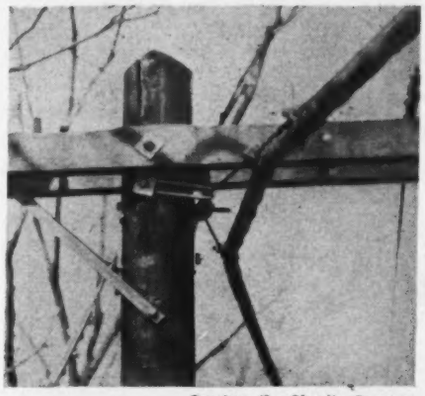
There is a difference of opinion between manufacturers as to possible damage to the cable if the messenger is allowed to spiral it, but in any case the time and effort to keep it straight is very small when the ball-bearing swivel is used. The appearance of the job when the cable is kept below the messenger is greatly improved. Where the cable must pass over limbs additional running blocks were supported in the trees. By the use of these extra running blocks, and pulling the cable under tension, the cable was kept up high enough to prevent damaging trees or shrubs.

Temporary Dead-end

The last pole nearest the free end of the cable was temporarily guyed to act as a holding point for this section of the cable. The cable was held at this pole while a new attachment was made to the messenger. The messenger was then connected to the truck winch-line with a dynamometer. While this connection was being made up, the other end of the messenger was permanently attached

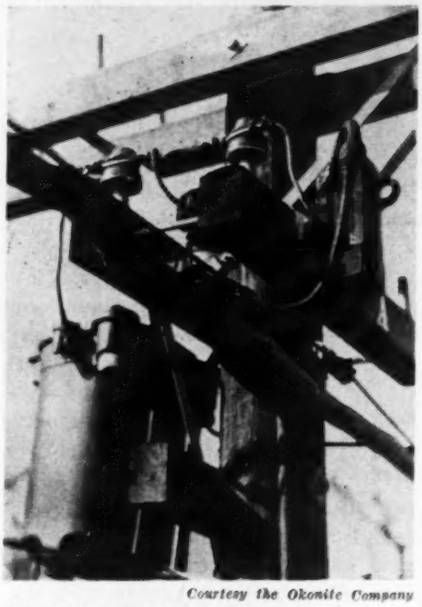
Courtesy the Okonite Company

CABLE SPLICE staggered with respect to messenger splice. Cable rings support splice. Shielding tape bonded to messenger. Effort made to keep conductors under messenger throughout



Courtesy the Okonite Company

CORNER POLE employs reinforcing links



Courtesy the Okonite Company

SINGLE-PHASE transformer tap

to the first pole with a thimble-eye bolt. The cable was pulled to a predetermined, initial stringing tension that would give the desired final maximum sag. By the use of a special come-along and Coffin hoist the messenger was anchored at the top of the temporarily guyed pole. Running blocks were removed and the messenger placed in the messenger clamps. This section of the cable was permanently "tied in." Reinforcing links were installed and any other work completed while the linemen were up the poles.

When placing the messenger in the clamp it was necessary to cut the binding tape and unwind it for about 12 in. either side of the pole. After the messenger was clamped, the tape was again wound around the cable and messenger properly to support the cable. The ends of the tape were clamped to the messenger with stock connectors.

Pulling blocks, pulling line, etc., were mounted on the next set of poles in readiness to receive the next reel of cable.

When the second reel was pulled into temporary position, the messengers of the two sections were spliced with a metal strand connector and three bolt clamps. The strand connector was placed 60 in. from the end of the cable so that the messenger splice was not directly over the cable splice. The cable ends overlapped 36 in. The second section was pulled to its permanent position and "tied in." The first temporary guy and "deadending" were then removed from the first section. This procedure was repeated until all the cable was installed.

We found that the seven-man crew could place the running blocks, pulling line and install the 1,000 ft. of cable in approximately seven hours.

Man-hours Required

A cable splicer and his helper followed the line crew, splicing the sections together and making the necessary taps for present and future transformers and lateral lines. This crew can average approximately six single-conductor splices or taps per day. Average number of single-conductor splices and taps is five per 1,000 ft.

Total labor to install the cable and make the necessary splices was approximately seven man-hours per 100 ft.

In the future we plan to have the cable made up in 1,200-ft. lengths, believing that the seven-man line crew and two-man cable crew can install a 1,200-ft. section in eight hours. This will reduce the installation labor to approximately six man-hours per 100 ft.

Material and labor costs for installing wooden tree guards appear to be slightly less for aerial cable than for tree wire.

At present the material costs for aerial cable are from 25 to 30 percent higher than tree wire. Total cost of the aerial cable installed can be expected to exceed that of tree wire by 12 to 20 percent.

Improved operation, appearance, and public acceptance of the aerial cable as compared to open wire will undoubtedly offset the additional cost.

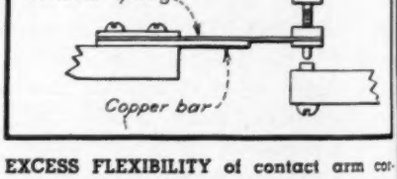
Sticking Regulator Contacts Remedied

By GEORGE READ
Rainbow Dam, Great Falls, Mont.

For several years the main contacts on a Tirrill or type T.A. voltage regulator in our generating station have had a tendency to weld together. This sticking would cause a rise of as much as a volt in the station 110-volt system and a corresponding drop when the regulating solenoids separated the contacts. Besides causing poor voltage regulation the arcing of the contacts when separated caused rapid pitting and burning of the contact surface. This is an important consideration because of the contact cost and because the precious metal they are made of is becoming harder to get.

Adjustment of the exciter field rheostats and overhauling of the regulator did not correct the trouble and it was finally attributed to system conditions.

Recently a very simple solution to the trouble was discovered. After noting how the flat spring upper main contact mounting caused the contacts to fly apart when separated it was decided the contact holder spring was too flexible. To remedy this one of the $\frac{1}{16}$-in. thick flat copper bars used for regulator relay contacts was placed under the main contact spring as shown in the diagram. This stopped the sticking, but caused the contacts to operate so fast the relay contacts fluttered instead of making good contact. One-fourth of an inch was then cut off the copper bar, which left about $\frac{1}{2}$ in. of the main contact spring extending beyond the bar and free to operate. This arrangement worked so well no further experimenting or adjustment was necessary.



EXCESS FLEXIBILITY of contact arm corrected by bar of 1/16-in. copper

This regulator is a G.E. type T.A., 100-125 volts a.c. and 70-140 volts d.c. exciter voltage, and was installed in 1910.

Plastic Insulations for Conductors [—Synthetics Not Akin to Rubber*

Properties of plastics rendering them suitable for use as insulation and sheath on wires and cables — Crucial shortage of crude rubber accelerates the transition to tried and new synthetics

E. D. YOUMANS, Vice-President and Technical Director, Okonite Company, Passaic, N. J.

CERTAIN PLASTICS have properties which make them feasible for use as insulation and jackets for wires and cables. In meeting the particular requirements of flexibility and plasticity (so that the conductors can be coiled, bent and pulled) the plastics need to have combinations of properties which might warrant calling them by a special name. Possibly "electric elastomers" might be an acceptable distinguishing identification.

Some of these synthetic plastics have been used for many years as insulation or jackets for electrical conductors. Their use and that of newer ones will be accelerated during ensuing months as the stocks of crude rubber dwindle still further.

List 27 of War Production Board Rubber Order R-1 dated June 18, 1943, and effective July 1, 1943, prescribes another step in the curtailment of the consumption of natural rubber for insulated wires and cables. Successive issues of these WPB regulations have imposed increasing restrictions, both on the uses of rubber insulated wires and cables and on the rubber content of the compounds.† The result is that there has been a substantial reduction in the amount of natural rubber required by the industry. For the third quarter of 1943 the wire and cable manufacturers are required by the WPB to accept neoprene, Buna S or Butyl synthetic rubber to the extent of at least 40 percent of their total rubber allotment. It is expected that the proportion of these synthetics required to be used in the fourth quarter of this year will be increased to at least 60 percent.

Manufacturers are cooperating closely with the Rubber Director's Office of the WPB and a great deal of work is being done in order to accomplish the transition from natural rubber with the least amount of disturbance to production or sacrifice of necessary service characteristics. Some of the older types of insulated wires and cables, particularly varnished cambric, are being used in substantial volume in place of rubber covered.

Transition Facilitated

There are, however, many purposes for which insulation and jackets with rubber-like properties are needed. The synthetic rubber or rubber-like materials must be used for such applications. The industry has already had considerable experience with the thermoplastic types made from Koroseal and Vinylite. Neoprene has been widely used for jacket compounds in recent years. On the other hand, Buna S and Butyl rubbers are the two synthetic materials which hold the most promise of yielding insulation with properties approaching closest to those of rubber insulation, but the industry has had relatively little experience with them.

Data on the synthetic materials whose characteristics make them most promising for use as the insulation or sheath on wires and cables where rubber compounds have been largely used in the past are given in the accompanying table.

Koroseal and Vinylite

The thermoplastic compounds made from Koroseal and Vinylite are the synthetics most widely used for conductor insulation at present. They are also used in large quantities for jackets or sheaths, particularly on shipboard cables. Their general nature is something intermediate between rubber and plastics and they are not classified as synthetic rubbers.

Koroseal is a plasticized vinyl chloride polymer and Vinylite is a plasticized copolymer of vinyl chloride and vinyl acetate. Each is available in several types having different dielectric properties or behavior at low temperatures. These variations are obtained by using different plasticizers or by changing the proportion of plasticizer. Some wire and cable manufacturers compound the Koroseal or Vinylite to obtain the desired characteristics similar to the manner in which crude rubber is compounded. Others purchase the materials from the suppliers all compounded and ready to use. The equipment used for production of wires and cables made with the thermoplastic synthetic compounds is similar to that used for rubber compounds including mixing and warm-

*This is the third in a series of articles treating plastics appropriate for electrical applications. Preceding articles appeared in the April 17, 1943, and June 12, 1943, issues of "Electrical World."

†Effective September 1, 1943, rubber will be restricted to use on conductors solely for military purposes.

ing mills and extruding machines. The greatest difference is that the thermoplastic compounds do not require vulcanization.

The dielectric characteristics of these thermoplastic synthetic compounds are adequate for wires and cables for use up to 600 volts for power and lighting circuits, for apparatus and instrument wiring and for many other low-voltage applications. There has also been some rather limited experience since the rubber shortage in the use of thermoplastic compound insulated cables for underground series lighting cables up to 5,000 volts. While they possess good dielectric strength, their relatively high dielectric constant and power factor make the thermoplastic compounds unsatisfactory for use as conductor insulation at higher voltages. These characteristics are also undesirable for communication cables.

Limitations in Use

Thermoplastic synthetic compounds made from Koroseal and Vinylite have satisfactory physical or mechanical properties over a fairly broad temperature range, but are not equivalent to high-grade rubber insulation in this respect. It is characteristic of thermoplastics to soften and flow more readily as the temperature increases and to stiffen or harden as the temperature is reduced. The 1940 edition of the National Electrical Code limits the conductor temperature of type SN (thermoplastic synthetic insulated) wire to a maximum of 60 deg. C. For some purposes higher operating temperatures such as 75 deg. C. are permitted, but in such cases the constructions usually include some form of protective covering over the thermoplastic insulation, which helps to prevent pressure from causing it to flow as readily.

Type SN wire does not have a fibrous or other covering over the insulation. The maximum safe operating temperature for the thermoplastic synthetic compounds is the temperature at which they become too soft rather than that at which aging is too rapid, as in the case of rubber and other types of conductor insulation. In general, the thermoplastic synthetic compounds which have been most widely used are much harder and stiffer at —10 deg. C. than at room temperature and there is dang of the insulation being damaged wh being installed at temperatures belo —10 deg. C. While care must be exe cised not to handle the wire at to low temperatures during installatio once installed the thermoplastic sy thetic compound insulations, if n disturbed, will withstand exposure t the lowest temperatures likely to b encountered. Good progress has bee made, however, toward improvin the low temperature characteristic and compounds are now availabl which are flexible enough at —5 deg. C. to withstand reasonable bend ing of the insulated conductors.

Favorable Properties

Other important characteristics o the synthetic thermoplastic insulation compounds made from Koroseal and Vinylite are as follows:

1. Moisture resistance equal to that of good rubber insulation.
2. Excellent aging and stability a both room temperature and at recom mended operating temperatures.
3. Resistance to attack by mineral and vegetable oils, by most acids and alkalies and many chemicals.

Synthetic Materials With Promising Characteristics as Alternatives to Rubber for Wires and Cables

Name	Chemical Type	Remarks	Type of Use	Dielectric Prop.	Chem. Prop.	Resis. to Ozone & Sunlight	Physical Prop.	Nonflammability	Oil Resis
Koroseal	Plasticized Vinyl chloride Polymer	Thermoplastic. Extrudable. Several types.	Insulation or Jacket	F	E	E	G	E	E
Vinylite	Plasticized Vinyl chloride-Vinyl acetate Copolymer	Ditto.	Insulation or Jacket	F	E	E	G	E	E
Neoprene	Chloroprene Polymer	Vulcanizable. Rubber-like. Extrudable or calendered strips. Several types.	Jacket	P	E	E	G	E	G
Buna S	Butadiene-Styrene Copolymer	Vulcanizable. Rubber-like. Extrudable.	Insulation or Jacket	G	G	F	G	P	F
Butyl Rubber	Isobutylene-Diolefin Copolymer	Ditto.	Insulation	G	E	G	G	P	P
Hycar OS-10	Butadiene-Styrene Copolymer	Vulcanizable. Rubber-like. Extrudable. Higher styrene content than Buna S.	Insulation or Jacket	G	G	F	G	P	F
Hycar OR-15 and OR-25	Butadiene-Acrylonitrile Copolymer	Vulcanizable. Rubber-like. Extrudable or calendered strips.	Jacket	P	G	P	G	P	G
Perbunan	Ditto	Ditto	Jacket	P	G	P	G	P	G
Chemigum III	Ditto	Ditto	Jacket	P	G	P	G	P	G
Thiokol	Organic Polysulfides	Both thermoplastic and vulcanizable types. Extrudable.	Jacket	P	G	E	F	P	E
Polybutene	Isobutylene Polymer	Not vulcanizable. Rubber-like. Mixed with resins or rubber. Extrudable.	Insulation	E	E	E	F	P	P
Polythene	Ethylene Polymer	Thermoplastic. Extrudable.	Insulation	E	E	E	E	P	F
Saran	Vinylidene chloride-Vinyl chloride Copolymer	Thermoplastic. Applicable as threads or tapes.	Insulation	F	E	E	G	E	E
Tenite II or Kodapak	Cellulose Derivative	Thermoplastic. Extrudable or applicable as tapes. Cellulose-acetate-butyrate.	Insulation	F	G	G	G	F	G
Ethyl Cellulose	Cellulose Derivative	Thermoplastic. Extrudable. Cellulose ethyl ether.	Insulation	F	G	G	G	F	G

E—Excellent, F—Fair, G—Good, P—Poor. Dielectric properties include dielectric strength, capacity, power factor, insulation resistance, etc. Chemical properties include resistance to oxidation, acids, alkali and moisture. Physical properties include tensile strength, elongation, modulus, toughness and abrasion resistance.

4. Not affected by sunlight or ozone exposure.

5. Non-flammable.

The difficulty of obtaining a good bond between layers of the thermoplastic synthetic insulating compounds makes waterproof splices a problem. The use of a thermoplastic synthetic splicing tape of similar composition to the conductor insulation requires heating of the wrapped splice under pressure to get proper adhesion of the splicing tape to the original insulation and between layers. Such practice is often impracticable in the field and most splicing has been done by using rubber splicing tape and friction tape, the same as when splicing rubber-insulated conductors. This provides a fairly good moisture-proof splice which has worked well.

Actual service experience with the thermoplastic synthetic compounds started back in 1936 on Navy shipboard cables. Their non-flammable nature, combined with excellent moisture resistance, was responsible for their use at that time rather than the need for substitute materials, as there was then no shortage in our supply of rubber. Navy shipboard cables have since been made with these materials on an increasing scale and extremely large quantities of the thermoplastic synthetic compounds are used in their manufacture at present. Recently the WPB prohibited the use of rubber, either natural or synthetic, in cables for fixed installations on cargo ships. The thermoplastic synthetic compounds are, as a result, being used for conductor insulation and for waterproof sheaths on these cables The huge cargo ship building program requires a great amount of cable with a corresponding large quantity of the thermoplastic synthetic compounds.

Specifications

Production of wires and cables insulated with the thermoplastic synthetic compounds for many purposes followed quickly after their first use on Navy shipboard cables in 1936. Probably the best known is the type SN small-diameter building wire, which, after extensive laboratory investigation and considerable service experience, was recognized in the 1940 edition of the National Electrical Code. Today these thermoplastic synthetic compounds are so well established as standard materials in the wire and cable industry that there are several accepted specifications available for use by the industry. Some of the more important of these specifications are as follows:

Underwriters' Laboratories, Inc., Standard for Synthetic-Insulated Wires.

American Society for Testing Materials, Emergency Specifications for Insulated Wire and Cable, Polyvinyl Insulating Compound.

National Electrical Manufacturers Association, Standards for Thermoplastic Synthetic Insulated Wire and Cable (600-volt ratings).

National Electrical Manufacturers Association, Standards for Series Lighting Wire and Cable with Thermoplastic Synthetic Insulation (3,000- and 5,000-volt ratings).

National Electrical Manufacturers Association, Standards for Thermoplastic Synthetic Jacket Compound for Wire and Cable.

Navy Department, U. S. Coast Guard, Master Specification No. S-255-42, Synthetic Insulation for Submarine Cable.

These thermoplastic synthetic compounds are now being used on wires and cables in large quantities in place of rubber. The capacity for the production of Koroseal and Vinylite has been greatly increased in the past two years. While the distribution of these materials is handled on an allocation basis by the WPB, this is done in order to assure an adequate supply for military needs. However, there is sufficient available for all necessary wire and cable uses and the WPB will allocate Koroseal and Vinylite at present for use as insulation on ungrounded conductors wherever copper is permitted to be used. There has been a steady decline in the price of the thermoplastic synthetic materials since they first became available. Their many advantageous characteristics make it likely that these materials will have a permanent place in the insulated wire and cable field.

An ensuing article will discuss Neoprene, Buna S, Butyl (all classed as synthetic rubbers) and other synthetics for special uses in connection with wires and cables.

• • •

Superheater Changes Extend Capacity

By E. J. DREWELOW
Chief Engineer Riverton Station, Empire District Electric Company, Riverton, Kan.

Increasing the superheat temperature of steam to prime movers is a potent capacity extender that was used to good advantage at the Riverton, Kan., station of the Empire District Electric Company recently when certain 200-psi. Sterling-type, stoker-fired boilers were converted to gas-oil firing.

Increased furnace volume and reduced excess air, resulting from removal of the stoker and chain grate, increased the steaming capacity of these boilers from 22,500 to 30,000 lb. per hour. However, total steam temperature dropped from 520 to 470 deg. This reduction was more than recovered by subsequent rebaffling to throw the superheaters in the first gas pass and by installing cores in the superheater tubes. These changes not only restored the lost superheat but actually increased the total steam temperature to 575 deg., thus realizing the fullest advantage from the increased boiler output.

The boilers were equipped with B&W type bare-tube, U-bend superheaters rated 100 deg. superheat at the header. The 55 deg. increase in total steam temperature above the original 520 deg. was partly due to the change in the baffling already noted, but a considerable portion was also due to the installation of cores in the superheater tubes. To install the cores the superheater elements were removed and lengths of ¾-in. pipe, closed at the ends, were installed in the 8-ft. straight sections of the superheater elements. To center the cores in the 2-in. O.D. superheater tubes centering pins were welded to the core tubes at about 2 ft. intervals.

Effect of Cores

Effect of the installation of the cores was to reduce the sectional area of the superheater tube to around 63 percent. This increased the amount of steam passing through the zone adjacent to the heated surface of the superheater tube.

These changes in the superheater arrangement have not only increased the total steam temperature but have also made it possible to operate the boilers with a maximum variation in steam temperature of 20 deg. in the operating range from 75 to 200 percent boiler rating.

A.C. Board Saves Critical Materials

Typical examples of avoidance of unnecessary equipment and line purchases as result of board analysis of problems illustrated by five specific cases

C. F. WAGNER, Manager Central Station Engineering, Westinghouse Electric & Manufacturing Company

CONSERVATION of critical materials by the avoidance of equipment and line purchases has been furthered in many cases by analysis of the problem on the a.c. calculating board. Typical instances of the application of the board may be enumerated as follows:

1. Because of the complexity of some systems, the appropriate rating of additional equipment is difficult to estimate even with a thorough knowledge of the system. To play safe the purchaser might then purchase apparatus of greater rating than required.

2. Regulators in looped paralleled circuits may preclude the necessity of adding circuits to carry the required load.

3. Capacitors distributed throughout a system near the loads may postpone or eliminate entirely the addition of extra feeders or larger transformers.

Under the present national emergency system additions require somewhat closer scrutiny than would be the case under normal times. Today, therefore, the a.c. calculating board accretes new importance. It is the purpose of this article to illustrate by several examples specific cases in which the board was of assistance in arriving at the most economical solution both from the standpoint of money expenditures and the use of critical materials.

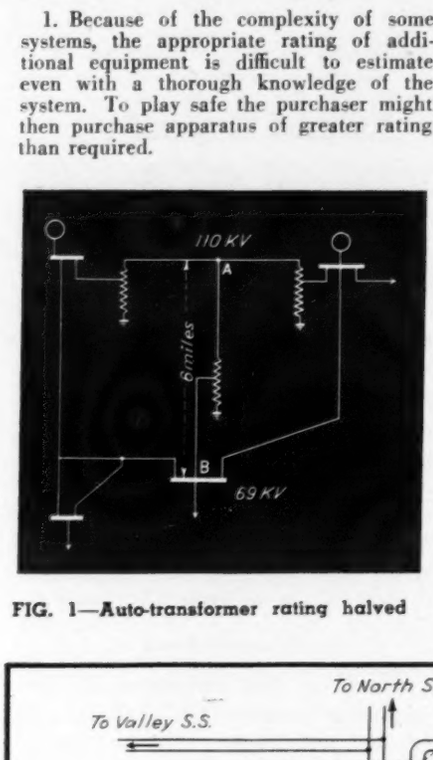


FIG. 1—Auto-transformer rating halved

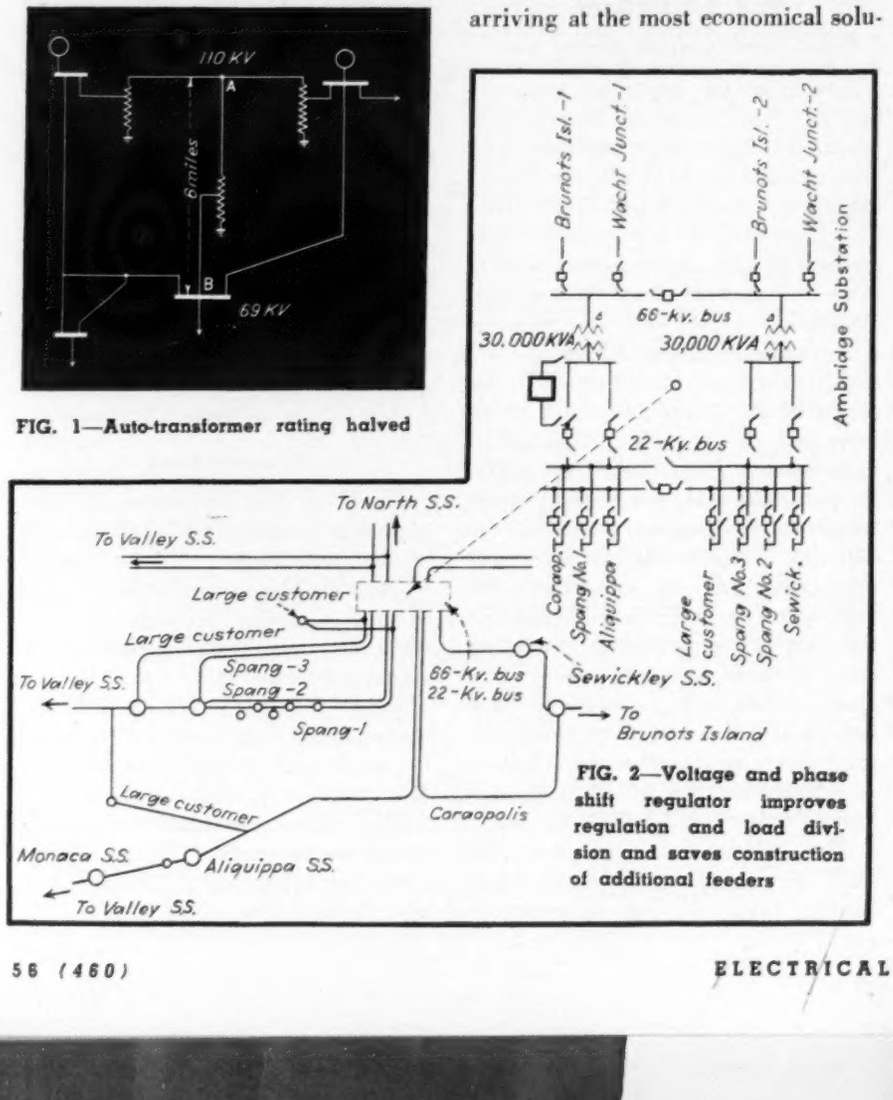


FIG. 2—Voltage and phase shift regulator improves regulation and load division and saves construction of additional feeders

Even quite simple systems are difficult to calculate analytically when they involve loop circuits. Fig. 1 shows a 69-kv. system involving a 110-kv. tie line between two generating stations. Due to load growth at the two distribution points in the lower part of the diagram the 69-kv. circuits feeding these loads had become overloaded, resulting in poor voltage regulation. The 110-kv. line passes within 6 miles of one of the 69-kv. buses and it was decided that the installation of an auto-transformer and suitable tie lines, between A and B, would offer a solution to the regulation problem. The operating engineers, having an intimate knowledge of the system, estimated that a 30,000-kva. transformer was necessary. When set up on the calculating board the load flow was determined in a relatively short time for all of the likely loading conditions and transformer taps. The board studies definitely proved that a 15,000-kva. auto-transformer would be sufficient for present maximum loads and that with the future addition of air-blast equipment this 15,000-kva. unit would be of sufficient capacity for many years in the future.

Regulation Problems

The calculating board is particularly valuable for the solution of regulation problems involving loops and step regulators that may insert a regulating voltage that is variable both with respect to magnitude and phase position. In Fig. 2 is shown such a system. It represents the 66-kv. and the 22-kv. buses at the Ambridge sub-

station of the Duquesne Light Company and also the connected lines. Because of the loops formed by the 22-kv. circuits, together with parallel circuits on the 66-kv. side, the natural flow does not always load the circuits in proportion to their current-carrying capacities or produce acceptable voltage conditions. Installation of a regulator, variable both in magnitude and phase position, in the 22-kv. system permits balancing the load both during normal and emergency conditions. The installed regulator can insert a series voltage of from 0 to 10 percent magnitude at 30, 60 or 90 deg. in any of the seven 22-kv. circuits. The 12,000-kva. (circuit rating) regulator permitted an increase of 4,000 kva. in the firm power rating in the substation. This increase in rating in itself is worth more than the cost of the regulator installation.

One alternative to the installation of a regulator was the construction of additional line capacity, which, of course, would not possess the flexibility of a regulator either for normal or emergency conditions. Set up on the calculating board, the loading of individual circuits and the voltage conditions at different points on the system were determined quickly and accurately for a large number of normal and emergency operating conditions. A more detailed discussion of this installation can be found in an article by W. J. Lyman in the ELECTRICAL WORLD, February 21, 1942, page 60, under the title of "Multi-Purpose Regulator Aids Voltage, Load Control."

Stability Problems

The complexity of stability problems makes their solution by the board one of its most useful applications. Even in normal times the end sought is the most economical means by which the desired power distribution can be obtained. The following example solved recently on the board illustrates the case in point. The system shown in Fig. 3 consists essentially of three sources of generation tied together through a backbone of 138-kv. transmission lines. In addition to the lines shown, there are also a number of 66-kv. lines that tie all of the generating sources together. A tap from the 66-kv. system, shown at the top of the diagram, is the supply to a new ordnance plant, for which

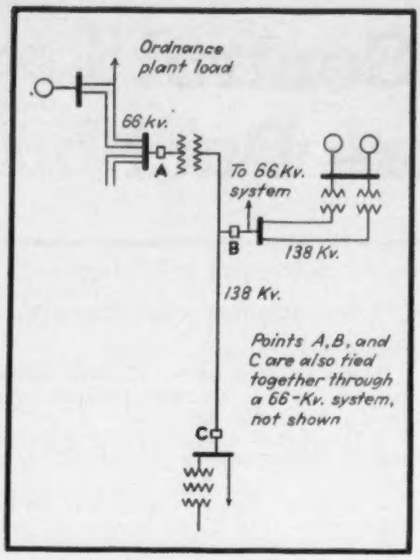


FIG. 3—Automatic reclosing features applied to breakers A B and C save construction of additional tie lines

it is imperative that good service be maintained.

Calculating board studies have shown that faults at any point on the 138-kv. system between A, B and C produce system instability and the dropping of the ordnance plant when the faults are relayed with present slow-speed induction type relays. Rapid removal of the fault by means of high-speed impedance type relays, however, prevents dropping of the ordnance load, the tie being maintained through the 66-kv. system paralleling the 138-kv. lines. As might be expected, the 66-kv. system becomes severely overloaded and intolerably poor regulation results at numerous intermediate load points. By the application of 30-cycle gang-operated reclosing features to the three breakers controlling the 138-kv. line the system can not only be made stable but system operation becomes entirely satisfactory from the standpoint of load division and voltage regulation. The only alternative to this solution is the construction of additional lines, which, under the present urgency of reducing the use of critical materials, would, of course, be highly undesirable.

Application of capacitors is particularly well adapted to calculating board analysis.

Capacitors are most frequently used to correct voltage conditions. On one 33-kv. system studied on the board (see Fig. 4) the projected load growth superimposed upon the existing loading indicated that at points remote from the generating points the voltage dropped to about 70 percent. The low-voltage condition was aggravated by the necessity of starting a large motor at the point A. Conditions were studied for the installation of combinations of shunt and series capacitors at the points indicated. Shunt capacitors alone, without provision for switching, corrected the load condition, but resulted in excessively high voltages at light load. The alternative to the solution involving the installation of series and shunt capacitors is the construction of additional lines or the conversion of existing 33-kv. system to 66-kv.

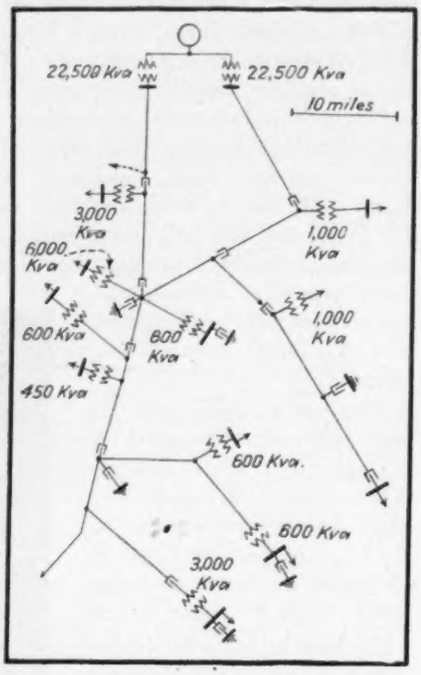


FIG. 4—33-Kv. system studied for application of combination of shunt and series capacitors

Other applications of capacitors, along with improving the voltage conditions of the system, permit greater loading of existing equipment. To cite one example, such a study made on a system of relatively low power factor (70 percent) was made up largely of pump motors. Capacitors totaling about 20,000 kva. were distributed throughout the load area to correct the power factor to about 80 percent. The studies indicated that by adding other load of 70 percent power factor the total load could be increased from 101,000 to 126,000 kw. without exceeding the kva. rating of the generator.

Substation Control Lines in Fibre Duct

DUE to the present shortages in vital materials and with the idea of saving steel, it was decided to use fibre conduit in one of the large substation construction jobs in Canada. Use of fibre conduit in control circuits is not new, usually 2½-in. fibre ducts were used and multiple control cables pulled into these ducts. When a large piece of electrical equipment required three or four lead-covered control cables to supply control and operating circuits it has not been unusual to use one fibre duct, sometimes as large as 3½ in., from the manhole to the apparatus and pull all cables into the one duct. This practice has not been generally extended to the smaller sizes of fibre duct and to inside construction design.

The switchboard sills in the main control room (Fig. 1) are all in place and the fibre conduit is being run; this fibre is equivalent to 1½-in. iron pipe size and is designed to carry lead-covered control cables in all runs where they lead to the outdoor switchyard via manholes and ordinary braid cables where the runs are not underground or go directly to indoor apparatus or switchboard ties.

The outstanding points of construction are:

1. *Relative Cost.*—Price of fibre conduit is much cheaper than the equivalent sizes in iron or steel.

2. *Installation Cost.*—Fibre in this size can be installed much cheaper than iron conduit.

3. *Bending*—Bends up to 15 deg. can be easily made (Fig. 2) by heating the conduit and bending, letting the conduit cool while holding the bend. The 45-deg. and 90-deg. bends were pre-fabricated and were shipped to the job ready for use. Some of the 90-deg. bends in the large 36-in. radius were cut and the ends retapered on the job to obtain all odd angles.

4. *Joints.*—All tapered joints were well covered with pitch during the assembly, special couplings were supplied with taper fittings on one end, 1½-in. I.P.S. tap in the other end, thus for the purpose of connecting fibre to steel sills, and all other places where the change was made fibre to steel.

5. As many as five layers were made in the 13-in. fill; using steel conduit the fill depth could have been somewhat reduced.

6. For lighting conduits ¾-in. and ½-in. steel conduit was still used as the runs are usually in walls and have to be self-supporting during the construction; if the walls were to be poured fibre could be used, but the relative saving would be less.

1. *Wastage and Scrap.*—A small hand lathe was used to retaper all small pieces and there was practically no waste or scrap; pieces as short as 6 in. were used and the labor of cutting a taper was extremely small.

Conduits were "held down" to the floor (Fig. 3), to keep them from floating when the floor was poured.

This construction job required about 14,000 ft. of straight fibre conduit (this came in 5-ft. lengths), also 3,000 standard couplings, 750 special taper to threaded couplings. There were 500 bends which included 100 "S" bends; the 90-deg. bends were 12, 24 and 36 in. radius sizes. This completed the present construction, which amounted to about 17,000 linear feet 1½-in. conduit; the ultimate construction will require 25,000 ft.

Steel conduit, 1½-in. size, weighs 2¾ lb. per linear foot. On the present construction more than 46,000 lb. of vital material was saved.

All conduits and fibre fittings for this construction job were supplied by Dominion Tar & Chemical Company, Fibre Conduit Division, of Cornwall, Ont. The electric heating oven, which was made on the job, used two 1-kw. strip heaters. Conduit was heated to about 200 F. before bending.

FIG. 3—Conduits in auxiliary control room also fibre

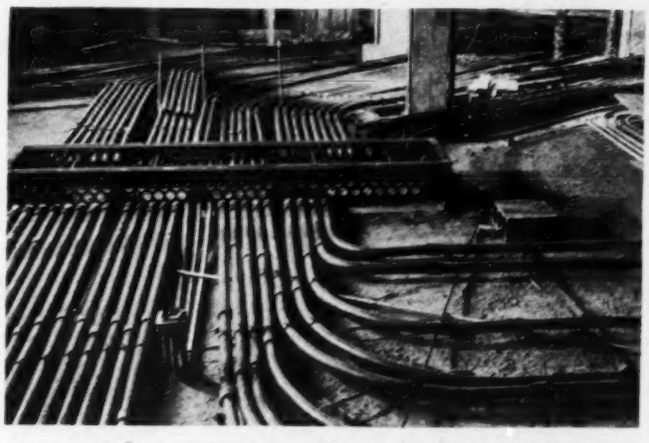


FIG. 1—Main control room conduits are of fibre equivalent to 1½-in. I.P.S.

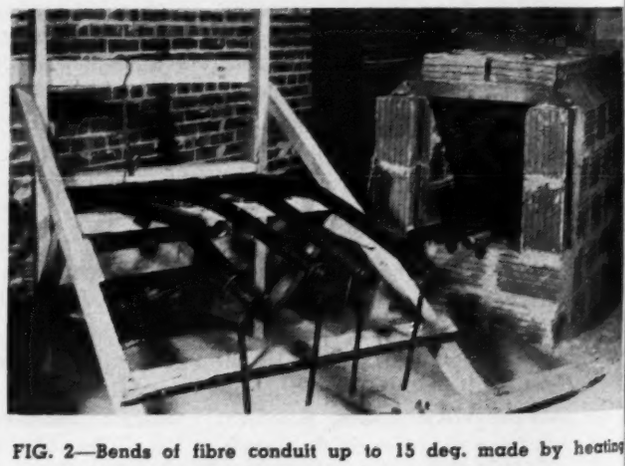


FIG. 2—Bends of fibre conduit up to 15 deg. made by heating to 200 F. in 2-kw. strip-heater oven

Maintenance Practices for Penstocks and Flow Lines

Preventive inspection and maintenance techniques for hydraulic structures associated with hydro-electric plants — Schedule is worked out to insure efficient operation and maximum service

JOHN M. SPAULDING, Pacific Gas & Electric Company, San Francisco*

INSPECTION of any structure is made primarily to keep that structure in good operating condition. Therefore the person making the inspection must not only be thoroughly familiar with the structures but also should know enough regarding their design to enable him to recognize a dangerous condition when such a condition is observed. This applies particularly to the hydraulic works associated with a hydro-electric plant, and these requirements are best met by using men who either, though having little formal education, have through years of experience gained the necessary knowledge, or men who have formal technical education plus a few years of experience.

Under normal conditions of scheduling preventive maintenance work is set up as much as two years in advance of the time when the job is to be done. Before the era of priorities and material shortages, such scheduling permitted materials to be purchased and equipment and labor allotted to the job. Today we do the best we can to keep water flowing to plants with materials that can be obtained and manpower available.

Even so, careful inspection is essential. Following are our inspection schedule and maintenance program. The latter is based upon conditions existing before priorities clamped down, but it can be modified in the light of available materials.

INSPECTION

Penstocks and Pressure Pipe Lines

A. Steel Lines

1. *Check condition of paint* outside and inside.

2. *Check condition of plate*, particularly for corrosion from outside where lines are buried or half buried. Check plate thickness by drilling hole through plate and calipering; pick thin spots so that worst condition can be observed. (In siphons check inside at lowest point for wear from gravel). Where possible, examine inside of pipe for tuberculation and check depth of pits under the tubercules. If pipe is badly corroded on outside, cause of corrosion must be determined, whether electrolysis or soil conditions.

3. *Piers and Anchors*—Inspect piers for undermining and for slides that might cause movement of the piers. Also check condition of concrete in piers for spalling and cracking. On both anchors and piers check hold-down straps.

4. *Expansion Joints*—Check for leakage and in bellows for cracks in plate.

B. Wood Stave Lines

1. *Check condition of staves* as regards rot, separation at ends, splitting, crushing and erosion on inside.

2. *Check bands* for rusting, too loose or too tight.

3. *Piers and anchors*—Same as for steel lines.

C. Concrete Lines

These lines are usually buried. Inspection is made only if leakage is indicated or if water carries sand or gravel that might cause erosion. On exposed steel and wood stave lines on piers, check should be made for earth piled against the pipe.

Tunnels

A. Pressure Tunnels

1. *Unlined*—Check for loose rock and erosion.

2. *Lined*—Inspect for holes through lining. If holes and cracks through lining are numerous in any area, a hole should be opened through the lining and check made for cavities behind lining. Also inspect for corrosion.

B. Flow Tunnels

1. *Unlined*—Check for loose rock and erosion.

2. *Concrete, lined*—Check for holes, cracks, etc. If concentrated cracks appear, check behind lining for cavities.

3. *Timber, Lined*—Check timber for rot and indication of movement. Check condition of blocking. If necessary, open up and go behind lining; this is very important.

Open Conduits

A. Canals

1. *Unlined*—Check for erosion, particularly in bottom and on berm side. Erosion on upper side may cause a slide into canal, but bottom and berm erosion may cause leakage that will result in loss of canal. *Check for leakage*—This is a constant check. *Check water level*—Low water level indicates obstruction, sand deposits, gravel, moss, boulder, tree, etc.

2. *Lined*—Design of lining must be known so that it can be inspected with a knowledge of what may constitute trouble, the water load it can stand, earth pressure it can take with water out of canal, etc.

Masonry, Dry—Inspect for cracks due to settlement.

Masonry, Wet—Inspect for cracks and undercutting. Check pointing for action by water and frost.

Gunite—Check for cracks and erosion, and for water action.

Wood Paneling—Check for rot.

In all lined canals attention must be given to the possibility of cavities developing behind the lining due to settlement, removal of material by water, etc. Cavities may cause failure of lining since the lining is usually not self-supporting and is designed and installed as a protective membrane only.

B. Flumes

1. *Wooden*—Check for rot. Pay particular attention to posts, stringers, caps and yokes. Rot will probably occur at joints and at contact with earth. Settlement due to crushing of timbers will sometimes indicate weak point. Also presence of fungus on wood indicates presence of rot. Also check for algæ and aquatic growth.

2. *Metal*, Wooden Substructure—Check same as for wooden flume. Check grade as metal flumes are more critical than wooden flumes as regards grade changes. Check metal for paint condition and for erosion; also for algæ and aquatic growth.

3. *Concrete*—Check concrete for disin-

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tegration due to frost action, action by water, etc. Also, grade should be checked as these flumes are usually designed closely and may not have much freeboard. Check for algæ and aquatic growth.

With all flumes, footings should be closely inspected for movement, undercutting, slides that might move footing and for earth that has piled up around posts.

With all exposed structures and canals inspection of the terrain around the structure for loose rocks, trees, etc. which, in falling, might damage the structure or canal should be made at least twice a year. Growth of brush, grass, etc., around the structures must be watched so that it can be removed before it constitutes too much fire hazard. This is true of concrete and steel structures as well as wood structures.

MAINTENANCE

Pipe Lines

Maintenance work on pressure and flow lines is essentially the same, so attention will be given to pipe lines in general.

A. Painting

This is probably the most common type of work done on pipe lines. Before paint is applied all loose paint and oxide are removed by a combination of sandblasting, wire brushing and flame cleaning. Each method has advantages depending upon amount of surface to be cleaned, shape of surface and location. Paint is usually applied by spraying. Men must be provided with protective creams, goggles, hoods, gloves, respirators and in some cases clothes. If work is done in close quarters, forced ventilation may have to be provided through use of blowers. If inspection has disclosed considerable erosion on outside of pipe line and tests have shown the soil is hot, the pipe should be cleaned and wrapped before it is again buried. On the other hand, if tests show electrolysis, other steps will have to be taken.

B. Patching

1. *Steel Lines*—If inspection of the steel plate in steel lines shows dangerous thinness, the plate is usually patched by welding. Arc welding is to be preferred, as this method introduces less heat into the metal and is less likely to start rivets leaking, etc. The above type of repair presumes that water can be taken out of the line for repair. If water cannot be taken out, it may be necessary to use a patch clamp band. This type of joint consists of a gasket held in place over the hole by a steel band which is bolted around the pipe.

2. *Wood Stave Lines*—If staves are rotted for a considerable length, new staves should be inserted. If bad spot is of short length, a steel plate curved to fit the outside of pipe with a mastic gasket under the plate may be put over bad spot and held in place with the steel bands that circle the pipe. If bands are loose, they should be tightened. In some cases, due to crushing of staves, no more thread is available on the bands. In such an instance, nuts should be removed and a spacer washer put on rod and nut replaced. Ratchet wrenches should be available for this work. The portion that receives the most sun and weather exposure deteriorates the most; this is usually about one-third of the circumference of the pipe. Experimental work is now being done with paints to determine if it is possible to cover the pipe to prevent the weathering.

3. *Concrete Lines*—Maintenance work on these lines is only that of patching a few leaking joints with cement mortar.

Tunnels

A. Pressure Tunnels

1. *Unlined*—Loose rock in side walls and ceiling should be brought down and removed. Transportation in these tunnels is the toughest problem. If tunnel is short and bottom smooth, tractor equipment may be used. If bottom is rough, track will have to be laid and cars used, either moved by hand or battery locomotives. Erosion, if serious, is best repaired through use of concrete in spots where rock erosion indicates soft spots.

2. *Lined*—It is essential with this type of tunnel to know the kind of ground encountered along the tunnel line. Such knowledge is very valuable in planning tunnel repairs. Repairs in this type of tunnel usually consist of plugging holes and cracks in the lining (such holes allow water behind lining and cause erosion, etc.). If holes are numerous and leakage indicates loss of water, lining should be opened enough to allow examination of ground condition in rear of lining (particularly where lining will not take water load without backing from ground). If examination shows cavities that must be filled they may be, if small, filled by grouting with cement grout or a sand-cement-bentonite grout. If large and continuous, it may be best to drive a drift along top of tunnel and work from the drift to backfill behind lining. In any event, during repairs cutoffs should be grouted along the tunnel in order to stop the movement of water behind the lining. The lining may be repaired by gunite or by placing of concrete patches.

B. Flow Tunnels

1. *Unlined*—In this type of tunnel about the only work involved is the removal of loose rock from roof and side walls, and removal of any debris that may have lodged on the floor. Work is carried on in same manner as for unlined pressure tunnels. Also, any erosion must be checked.

2. *Concrete, Lined*—Holes due to erosion must be patched. If inspection discloses need, repairs must be made in same manner as for pressure tunnels. Trouble with these tunnels is most likely to be due to external rather than internal pressure.

3. *Timber, Lined*—Repairs to this type of tunnel involve mostly the replacing of rotted timber. Early in the life of the tunnel this is simple, as extra sets can be put in between the old sets to hold the lagging in place. When no more space for extra sets is available or because the lagging has rotted, the tunnel must be retimbered. This involves removing of old timber and placing of a complete new lining and is a slow, difficult job, particularly in soft ground. It is better and results, in the long run, in a saving in money, if sets are replaced in their original location and additional sets only installed where lagging shows signs of overloading or is being weakened by rot. In this way sets are kept in good shape and the lagging may be replaced more easily than with the method of installing additional sets until no further sets may be installed. Particular care must be given, especially in soft ground, to blocking the sets and lagging in place, as erosion may loosen insecurely blocked timbers and cause a jam. Where possible, cutoffs should be installed to prevent flow of water behind the lining. Practice on all of our timbered tunnels now is to install preframed pressure-treated timber; creosote and salt-treated fir are favored.

Open Conduits

A. Canals

1. *Unlined*—Erosion may be stopped by lining with any of the various types of lining, or if head is available and erosion is great enough to justify the cost, a drop or check section may be installed. Erosion must be stopped as continued erosion will probably cause a canal break.

Leakage—Control or stop by puddling or lining with watertight lining of concrete or timber. Reinforced hand plaster or gunite are to be preferred.

Water Level—Remove sand bars, gravel, boulders, etc., that are holding back the water. On canals large enough to warrant, power equipment should be used.

Algæ, Moss, etc., may be killed and sometimes taken out with copper sulphate. If not, it must be removed by hand or machine. Tules are a source of trouble in large canals with slowly moving water. This growth is removed by draglines, or may be removed with a tule boat. This is a small flat-bottom barge with a gasoline-driven cutter bar operating under water. Depth of cut is adjustable and boat is moved by a small paddle wheel at the stern.

2. *Lined—Masonry, Dry*—Rebuild where settlement indicates incipient failure and extend where undercutting indicates need.

Masonry, Wet—Repair where frost and water action have removed mortar. Also repair foundations where undercut, using additional wet masonry.

Gunite and Hand Plaster—About the only method found feasible for repairing this type of lining is that of cracking the lining, removing and replacing with new lining. If only small holes need to be patched, they may be repaired by same method used for holes in any concrete surface. Cracks are sealed with tar-mastic compounds.

Wood Paneling—Recent repairs to this type of lining have used Port Orford cedar, incense cedar dipped in creosote and pressure-treated lumber. It is believed that the heart, irrigation-grade, Port Orford cedar is best for this purpose where canals are so irregular as to require considerable field framing of the lumber. It has been found that most of the early failures of this type of lining were due to rotting of the posts that held the boards. Accordingly, this type of paneling is being installed with 1-in. second-hand pipe for supports. This should increase life of lining considerably. In placing any type of lining, either new or repaired, particular attention is always given to the cross-section and alignment of the canal. When the lining is placed, the original cross-section of the canal is restored, even if considerable filling behind the lining is required. This restoration of cross-section reduces head loss due to eddying and will eventually result in a lowering of water surface in canal. This is borne out in several installations made.

B. Flumes

1. *Wooden*—The first consideration in work on these flumes is lumber supply.

As the labor involved per 1,000 b.ft. is usually twice that of the lumber cost, it pays to buy good lumber in order to secure longer life.

In fact, in some places where wood flumes must be maintained, pre-framed pressure-treated material is used.

Lumber handling equipment and power framing equipment are also prime requisites where large quantities of lumber are to be handled and framed. Power derricks, railroad tracks, gasoline locomotives, electrically driven saws, dado heads, drills, etc., are used to eliminate costly hand labor. Lumber yards must be clean and the bunkers of sound wood. Rot must be considered a disease and all sources of infection kept away from the new lumber. Fire protection is also provided at all lumber yards because of the combustible nature of material and because most yards are in areas where forest fires are prevalent.

Various methods are used in repairing the wooden flumes, but the ultimate aim is the same, namely, to have all parts of the flume give away at the same time. As some pieces of lumber have a shorter life than other pieces, due to exposure and loading, repair work must be done starting at the end of about five years from first installation. Additional posts, girders, and yokes are placed until the life of the structure is exhausted. Then the flume is torn out and a new one built. Any new timber that is not rot-infected may be salvaged and used.

2. *Metal*—Painting interior of flumes is one of the main maintenance jobs with this type of flume. Kerosene torches are used to dry the flume. Electric motor-driven wire brushes (electric power from portable gasoline-engine-driven generators) are used to clean the flume. Paint is put on with brush and with spray. Eventually all painting will be done with spray equipment. Girders, posts, etc., in the substructure must be replaced long before sheets must be replaced. Consequently, wood preserved with creosote-type paint has been adopted and the results so far are encouraging.

In replacing posts, girders, etc., an endeavor is made to do this work without dismantling the sheets. This has been accomplished through use of false girders, jack posts, "A" frames, etc., with very good results.

3. *Concrete*—The removal of algæ and aquatic growth is important. This has been accomplished very economically through the use of high pressure water jets. Where the concrete has deteriorated due to frost action and water action, it frequently must be restored in order not only to insure structural stability but also proper flow conditions. The interior may be restored with a hand-trowelled gunite surface or, where roughness is not too great, a paint job may sufficiently restore the surface to enable the required flow to be carried and at the same time stop further action. The paint is usually applied by spray equipment after cleaning by sandblasting, water jet or hand scraping.

In all flumes the grade must be watched and maintained. If flume has settled, it must be restored to grade by jacking or grouting. A low flume means high water surface and an extra load for the flume.

Slides, rocks, trees, etc., that might endanger the structures are removed by caterpillar equipment, hydraulicking or blasting. The method is determined by roads leading to the work, the amount of work and the speed required.

Electricity from Coal Mine to User

Each major step in the production and distribution of electricity is shown in this chart made by the Duquesne Light Company, Pittsburgh, Pa. The chart is used to acquaint valuation department employees with the parts of the system as an aid to the proper use of account classification numbers. The rate department uses it in rate studies. It is used for information of municipal officials, in explanation of power contracts and generally for education of employees and the public.

Large colored reproductions are framed and hung in offices frequented by customers.

PRIORITIES PROBLEMS

Clearing Inquiries With Regional Engineers

From comments and letters regarding the clearance of inquiries through regional engineers it appears that there is probably some doubt on the part of many utilities as to how they should proceed in purchasing materials under the restrictions of U-1.

Paragraph (j) of U-1 provides that no producer may place an order with any supplier, other than another producer, when such order totals $100 or more and is for any of the materials listed on Schedule "C," without first obtaining a statement from the regional utility engineer that such material is not available in the excess inventories of other utilities. *As noted in paragraph (j), this restriction applies also to materials required for new construction.* The effect of this provision of U-1 is to require all utilities to clear all orders through the regional engineer's office when an order totals more than $100 and is for material listed on Schedule "C." It is immaterial whether or not the purchasing utility has a preference rating for the material. The purchasing utility must clear all such orders through the regional office even though it may have the highest preference rating.

Preference Ratings

A utility receives its authorization to purchase and use materials by making application to the War Production Board for specific authorization for construction jobs, other than minor construction jobs, and by applying the blanket preference rating of U-1 for maintenance and repair jobs. When a utility files an application for authorization to proceed with a construction job, it is requested to indicate on the application what materials can come from its own excess stocks or from the excess stocks of other utilities and this information is taken into consideration in reviewing the applicant's application and in assigning preference ratings. For items involving considerable amounts of critical metal, the analyst in the materials distribution sections of OWU may check records in the inventory control branch to make sure that these items are available in excess.

From Other Excess Stocks

In case of doubt in the mind of the analyst as to whether or not specific materials are available in excess inventory, he usually assigns a preference rating which will obtain the materials from the manufacturer if the regional engineer finds that they are not available in excess. For items which appear to be available in excess, especially controlled materials items, the analyst may assign no preference rating whatever. In this case the utility is permitted by the authorization on the reverse of Form 2774 to obtain the materials without a preference rating from the excess stocks of other utilities and the utility which holds the material is permitted by the same authorization to release the material without a preference rating.

Most construction authorizations will, therefore, show preference ratings for some items of materials and no preference ratings for other items of materials. This should not be taken as an indication that the applicant is permitted to purchase rated items for a supplier and that he is required to get only the unrated items from excess inventories. If the applicant purchases any Schedule "C" materials (involving more than $100) from a supplier, he must first have a release from the regional engineer that such items are rated.

The primary purpose in not giving an applicant a preference rating for certain items of materials (usually controlled materials) is to prevent a charge against OWU's "bank account" of controlled materials. Any quantities of controlled materials which are authorized for new construction and which receive a preference rating and allotment number must be charged against this "bank account." The secondary purpose is, of course, to require the applicant to exhaust every possibility of obtaining such materials from excess inventories before going to the supplier.

If the regional engineer does not find rated items available in excess inventories, the applicant has no further problem in obtaining materials from a supplier, since he may apply the preference rating to obtain delivery and he has a statement from the regional utility engineer that such items are not reasonably available in excess. However, if the regional engineer finds that some of the applicant's unrated items are not available in excess, the applicant must either make further search with his own or other regional engineers for these materials in excess, or he must come back to the War Production Board with a request for a preference rating for such items.

No Ratings for Availables

The regional engineer may not authorize the applicant to purchase materials from a supplier. The regional engineer may only state that the materials are not available in excess, thus permitting the applicant to purchase materials from a supplier if he has a preference rating, but requiring the applicant to make further search for unrated items or to come back to the War Production Board for the assignment of a preference rating before purchasing from a supplier.

There is a general agreement with the Materials Distribution Sections of the Gas, Power and Water Divisions of OWU that it will not assign preference ratings to any items of controlled materials which seem fairly certain to be available in excess inventories. It will, in general, assign preference ratings to all materials other than controlled materials except for specific items (such as transformers, meters, valves, etc.) which OWU is reasonably certain are available in excess.

Regional Information

In some cases a utility will come to the regional engineer before placing an application with WPB requesting information as to whether or not certain items of material are available in excess inventories so that he can indicate in his application that certain items are in excess. A regional engineer should advise such a utility what materials are available in excess but should not freeze any materials pending action on an application.

OWU's Inventory Control Branch here in Washington will attempt to keep the various materials distribution sections advised on the quantities of materials available in excess and the regional location of such materials. Obviously, it cannot attempt to do this on all items of materials which come under Schedule "C," but it will attempt to keep the materials distribution sections advised on those items of materials in excess which involve the bulk of the metal content of the aggregate excess materials. To aid in this work, OWU expects shortly to ask regional utility engineers to report to Washington on "key" items of material—those involving the major metal content of excess inventories and some items which are particularly critical from a fabricating standpoint.

Replacing Operable Equipment

Case No. 77

The provisions of Order U-1 which allow replacement of equipment which fails to render service at minimum service standards does not allow replacement of equipment which renders such service, even though replacement would enable considerably more efficient operation. The idea is that with materials, particularly metals, critical in supply, a line must be drawn somewhere if there is to be maximum conservation of materials. In this case the line is drawn at the point at which equipment no longer will do the job. Sacrifices in operating efficiency which this ruling may require must be charged off to the war.

This philosophy is exemplified in the case of a utility which sought to replace steam drum baffles with steam scrubber baffles under U-1 on the basis that such replacement was necessary to operate a boiler at a given load without excessive carryover to the turbine. As long as the steam drum baffle remained in the boiler, the company found it necessary to operate at reduced loads.

As OWU saw the case, the question was whether the change could be made within the $500 limitation on above-ground installation. Above that cost, the changeover would be regarded as an addition to plant for which a special rating would have to be obtained.

Only if Incapable

If the steam drum baffles were to be found incapable of rendering service at minimum service standards, the replacement could be made under U-1, and cost would be calculated for this purpose on the basis of the difference between the new cost of steam drum baffles and the new cost of steam scrubber baffles. If this difference were less than $500, the permission to make the change would be automatic.

Inasmuch as the drum baffles were capable of minimum service and the change is suggested merely to improve operating efficiency, and inasmuch as the cost of the changeover would exceed $500, the company was notified that the improved baffles could not be installed under U-1. The company was told it would have to make specific application for a rating on the project so that the changeover and improvement could be considered on its own merits.

The ruling is not so arbitrary as it appears to be. With continued use of the drum baffles the company can continue to generate power and carry its loads. There was no question of failing to render service. It was merely a question of whether efficient operation is worth more than the materials and man- and machine-hours contained in the scrubber baffles.

In considering the case on its own merits and apart from the automatic provisions of U-1, it may be decided that the increased operating efficiency attainable with scrubber baffles is worth the material and man- and machine-hour expenditure, in which case the changeover would be approved.

Reworking Copper Conductor

Case No. 78

Through the adaptation of a practice of long standing in the industry, utilities are getting copper for transmission lines which they otherwise would not get. At the same time they are moving out of excess inventory and into war use critical materials which otherwise might lie dormant in inventory.

The practice is that of reworking copper conductor into smaller sizes. It entails a certain amount of extra expense, both in purchasing the conductor from excess inventory and paying a handling charge thereon and in paying the freight and reworking charges.

One utility which asked a rating on 30 miles of 300,000-cir.mil stranded copper conductor was granted authorization to perform the construction job provided it obtained its conductor from excess inventory. A thorough search of available inventory showed that the conductor was not available, but that there was available in excess inventory sufficient bare, solid, hard-drawn conductor to furnish the needed wire. The company was given an authorization to acquire as much of the bare, solid conductor as it needed to make the necessary 300,000-cir.mil redrawing into the proper size for stranding.

OWU reports surprisingly little complaint about the premium prices exacted by such authorizations. The idea seems to have sprung from utilities themselves. It was not uncommon in the past for utilities to salvage conductor, strip off worn-out weatherproofing and send the wire to wire mills for redrawing and reweatherproofing. The new practice apparently is an outgrowth of the old.

Editorials

S. B. WILLIAMS, *Editor*

Where Credit Is Due

A SPLENDID JOB has been done by the electric utilities in serving industry and the public during the war. Credit for this job has been given to management, to the manufacturers of the equipment, to the companies themselves. But there is another element to which belongs even more credit than all the rest, and that is the men and women of the industry. Why haven't they been publicized?

These people may not wear the uniform of Uncle Sam, but suppose they fell down on the job, as do some war workers, or shut down service through strike, or refused to work on some holiday, how many war plants serving the boys that are wearing that uniform would suffer?

Iron and copper and money are but the tools of people. Equipment cannot perform satisfactorily without brains and initiative and loyalty to the job behind them. In the advertising that the utilities prepare, let's see the credit given more frequently to flesh and blood. Even if the Office of War Utilities won't recognize their contribution with a Service "S," at least their own companies might publicly acknowledge their war contribution.

Rate Regulation by States Restabilized

THREE RECENT DECISIONS have done much to restabilize rate regulation and to strengthen state regulation against interference from the outside.

In Michigan the Public Service Commission dismissed a petition that Detroit Edison rates be reduced by the amount of excess profits taxes. In Wisconsin the commission in the Milwaukee Gas Light case denied the authority of OPA to interfere with the operation of a filed fuel clause. In Washington the District Court of Appeals denied OPA any jurisdiction over rate determination in allowing a rate rise to Washington Gas Light under the sliding scale agreement.

These cases definitely reaffirm the regulatory jurisdiction of the state commissions, put OPA in its place as defined by Congress and uphold established rates and rate-fixing procedures.

The attempt in Michigan to prevent utilities from paying excess profits taxes to the government on the theory that if there is excess profit it belongs to the customers might have had far-reaching consequences if successful. The Arkansas commission had already accepted that theory and by a retroactive reduction had made it effective. Had Michigan adopted the practice, other states undoubtedly would have been quick to follow suit.

The OPA interference was an obvious effort by a war bureau to extend its powers beyond those delegated to it by Congress. It seems now to be fairly well established that OPA has no power to seek rate reductions, to prevent rate increases or to interfere with the operation of established rates, such as fuel clauses.

While these interferences with the normal regulation of utilities have been very disquieting during the past year, in some ways they have been very beneficial, because in reaffirming the authority of the state the position of state regulation has been greatly strengthened over what it has been.

While none of these decisions greatly affect the immediate utility net revenue, they will have an important bearing on the terms of post-war utility financing.

Voluntary Conservation Is Another Opportunity

IN ANOTHER MONTH or so the voluntary conservation program to take the place of a mandatory brownout will be in effect. This is not a program to reduce the use of electricity because of any power shortage. It is a program designed primarily to save coal and transportation and also tungsten.

Contrary to some expressed fear, this is not a program aimed exclusively at the electric utilities—it is across the boards for American industry. Every one will be expected to contribute according to his ability.

Nor is this a punitive program, engineered by some of the utility industry's enemies in high circles. Had it been projected with any such animus it would never have been permitted to become a voluntary operation. Instead, it would have been mandatory, with a definite percentage of fuel saving and transportation saving stipulated—and that would have been bad medicine not alone because of the loss but because of the danger to customer relations from policing.

If there is some fear that, after telling the public that no power rationing has been necessary because we have plenty, it is going to look silly to ask customers to conserve, it might be well to remember that the customer can be a rather understanding fellow. He is just as likely to say if smart utility executives make a virtue out of the program: "What a shame that the light company has to ask us to cut down when there is so much power available. They certainly are putting their shoulders to the wheel of war in a magnificent and self-sacrificing way."

There have been some rumblings that the utilities ought to gear their effort to that of other industries. Fortunately, that's just a little blowing off of steam, for the electric utility fellows couldn't hold back if they wanted to. They have always done an outstanding job in any such co-operative efforts and they will do just as good a one in this conservation drive as they did in furnishing capacity.

In fact, this voluntary conservation program offers one more opportunity to build up good public relations by doing an outstanding job. It won't be easy. But, after all, isn't it the difficult job that offers the greatest opportunity to be a hero?

No Proof of Necessity Required

THE GOVERNMENT SEIZURE of the two remaining Porto Rican properties at San Juan and Mayaguez under the Second War Powers Act has received legal approval from the Federal District Court in Porto Rico. This, however, was a foregone conclusion, but the interesting thing brought out by the court is that businesses can be expropriated by the executive or administrative offices without proving necessity.

Obviously, for reasons of national security it would be unwise for the President or those to whom he had delegated part of his war power authority to be required to justify many of their actions. Such a situation, however, provides just the loophole that the public ownership boys want.

Of course, the courts by show of great concern over the fairness of compensation make the seizure look like a very fair thing. That is the crowning artistic touch, for the Administration doesn't care how much is spent. After all, it's only the public's money.

And this is the Administration that complains that its opponents cannot forget politics during the war.

Application of Building Codes to Government Property

LOCAL BUILDING CODES do not apply to government buildings constructed on land leased by the government is the sense of a recent federal district court ruling in Philadelphia. To house negro war workers FHA was building some dwellings which the city of Chester claimed were in violation of several chapters of the local building code.

Regardless of race discrimination or any other element that might have been a motivating factor, it is going pretty far when the government flouts local laws at its own convenience. It's bad enough when the government removes property from the tax rolls and builds thereon a housing project that costs the city large sums to serve with police and fire protection, and all of the other conveniences made possible through the imposition of taxes on the rest of the community, but now it wants to build as it pleases, regardless of local building and sanitation codes.

City codes are for the purpose of protecting all of the citizens against hazardous actions by the individual. Because they are in the public interest they are legally enforceable. Does government ownership of property, especially when tenants are not there upon government business, entitle it to endanger the public welfare? It is no defense to argue that construction is in accordance with federal standards. The city government has the authority to determine what is and what is not safe in its community. That is why we have departures from the National Electrical Code.

If the government feels that the code is too unreasonably restrictive it can get satisfaction in exactly the same way as it asks its citizens to act, not by seeking exemption, but by challenging the law in court in its application to all the people.

Utility Workers' Purchases of War Bonds

UTILITY MANAGEMENTS will be asked shortly, along with other employers, to encourage their employees to greater purchases of war bonds. It is estimated that about 80 percent of the utility men and women are currently buying bonds on the salary deduction plan to an amount of approximately 5 percent of total payroll.

Such bare figures do not look like anything to write home about until one investigates the conditions of utility employment. This industry is not a war baby. Its wages have gone up some, but nothing like those in war manufacturing. It has operated for years under a ceiling price, and that has had to be reflected in costs so far as they were controllable. For a somewhat modest yet steady wage the employees have received in turn a larger degree of job security. The natural result of this permanency has been a large percentage of home owners among utility employees.

With no war plant raises or bloated overtime slips, with living costs up and taxes also, and with proportionately heavy fixed commitments, how are utility employees going to squeeze out much more of their pay checks for war bonds?

The employee is not unmindful of his obligation as a good citizen. What is he to do? Go into debt or, as some war workers are reported as doing, buy bonds at the office and cash them at the bank? Or shall he take the other road and go find a war job that permits him to do a larger share?

We must be careful in encouraging people to invest more to remember that they have to live with their consciences. Their morale is worth far more than the few extra dollars they might, by squeezing, loan to Uncle Sam. Ten percent might be too little for war workers making many times the money they did in peacetime, while 5 percent for others, such as utility employees, might be a splendid job.

Washington Comment

R. N. LARKIN, Washington Correspondent

Civilian Durable Goods Maybe Yes, Maybe No

YOU PAYS your money and you takes your choice in Washington these days regarding the question of whether there is to be any appreciable increase in the production of durable goods for civilian use.

Leaving out the extreme categories of civilian supply—food and clothing, on the one hand, because they must be forthcoming regardless, and, on the other hand, bobby pins, safety pins, ice picks and the like, which can be made available quickly at a trifling cost in metal—there remains a hard core of items which are not now being produced, which are not now so easy to buy as they were a year ago and which shine as jewels of great price in the eyes of a civilian population.

Everybody Speculating

Limiting the discussion to the component items of this core, you can get any gospel you want on civilian supply in Washington today—and you can get the particular gospel you choose from people who are in a better position to know than the man in the street. And, finally, whoever tells you the story you want to hear is apt to believe sincerely that his story is the true one.

Newspapers and magazines have recently been full of speculation as to whether there will be increased production of electric ranges, mechanical refrigerators, washing machines, radios, automobiles, fans, electric irons, vacuum cleaners and the dozen or more other semi-luxurious items the production of which has been prohibited for a year or more.

Some believe that the ban on these items is about ready to be removed. Others label such speculation as a "plant" by manufacturers who want to capitalize on the lush market which exists for these items. One of the higher officials of the Office of Civilian Requirements agrees that the present agitation is a plant—but he believes it has been planted by those who are violently opposed to any increase in civilian production of such goods and who are attempting to drag the issue into the open prematurely, the better to strangle it once and for all.

Material Supply

The pragmatists answer the question with the blunt query, "Where are you going to get the metal?" and in this they have what appears to be a hard argument to surmount. On the other hand, the OCR official previously referred to is equally blunt in saying that the metal with which to supply "essential" needs of such items could be obtained "in 48 hours, and without affecting in the slightest any of the existing arms or civilian programs," if WPB would merely give OCR permission to make those essential items for which it could rustle up the materials. The material, he insists, is contained in partially fabricated inventories which were frozen when production was finally halted. It is hidden "under the rafters," in scrap piles and in a thousand odd places.

But a top man in the Consumer Durable Goods Division, to which OCR's durable goods requirements are constantly forwarded for review, says the metal frozen in partially completed inventories wouldn't make ranges for the doll houses which will be given out next Christmas.

The same OCR official who could find all this metal in 48 hours isn't too concerned about the long pull. The next three or four months, he says, will be the worst. Thereafter, things will be so bad that WPB will have to give OCR what it asks for. But another OCR official, of only slightly less stature, figures that there are enough complete items and non-assembled parts in inventory or frozen on manufacturers' shelves to meet the needs of a restricted replacement market for another year without crisis. Whatever shortages exist he blamed on hysterical buying and maldistribution, in a 90 percent-10 percent ratio. He argued that there were few items which just cannot be bought, either new or second-hand, and cited newspaper advertisements as proof of his contention.

One philosophy holds that there is no use in making driblets of durable goods. If only trifling amounts were available, the reasoning runs, civilians would disgrace themselves in the frenzy to buy. Therefore, goes the argument, hold up all such civilian production until enough can be produced to support rationing programs. This idea is obviously utterly at variance with the thought that in three or four months things will be so bad that guns will have to give way to washing machines. It is propounded principally by one of the men who passes on the programs which OCR takes to the WPB's Requirements Committee every three months.

Another example of intra-OCR contradiction is in the recent compilation of fourth-quarter requests for controlled materials (ELECTRICAL WORLD, July 31, 1943, page 6). The document calls for no material with which to make ranges, refrigerators and all the rest. Nor does it call for metal for replacement parts for existing appliances. This is an official OCR document and apparently is the justification for OCR's requests for steel, copper and aluminum for the last quarter.

Some Day

The only angle of the argument on which there is much agreement is that these durable goods will be produced "some day." Even here an argument rages over the date of "some day." The services may be counted upon to approve such production 24 hours after the war ends. Top WPB men seem to think that will be started immediately that an appreciable amount of idle labor, plant and material can be found. They see this as a means of cushioning the ultimate deflation of war industry.

NEWS OF THE WEEK

Houston, Galveston Hit in Record Hurricane

Power and telephone lines down, energy cut off, in area of storm which caused an estimated $12,000,000 damage — Houston Lighting worked day and night to restore service

One of the worst hurricanes in the history of the city struck Houston, Texas, at 5:30 p.m. July 27 with gradually increasing winds, one gust being 132 miles per hour, which disabled all utility lines, caused a failure of power throughout Harris County, disabled 6,000 telephones here and another 6,000 in Galveston, as well as outlying lines, tied up defense industries from a few days to three weeks, threatened food supplies because of failure of refrigeration and inflicted damage said to be over $1,000,000 in Houston alone and some $12,000,000 in all.

Galveston Also Hit

The storm moved inland from the mainland to Galveston, where several million dollars damage was caused, and thence to Houston, accompanied by torrential rains which continued through Wednesday night. Many line wires, it was said, fell on telephone cables and burned them, exposing the wires to Wednesday rains. Telephone repair men from all over Texas were rushed to the city to hasten the tremendous repair job.

F. M. Austin, vice-president of Houston Lighting & Power, told the Federal Power Commission that the hurricane caused no serious damage to company property. No power plant or important substation was seriously affected, he said, the main damage being confined to transmission and distribution systems. Of the 270,000-kw. load of Houston Lighting, 120,000 kw. was knocked out in the course of the record gale. Mr. Austin reported he anticipates difficulty in getting steel to rebuild several important transmission towers which were blown down.

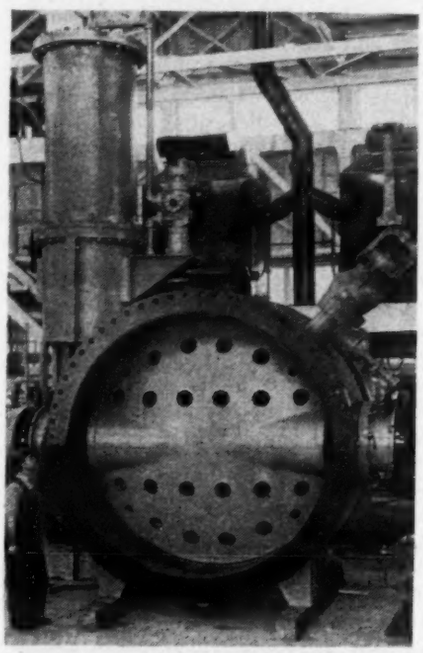
Lights in some residence sections were cut off only overnight, but in the larger portion of the city 60 percent restoration had been effected late Thursday, with total restoration Saturday or Sunday. This was the worst storm in the history of the Houston Lighting & Power Co., according to S. R. Bertron, president, who estimated the damage would far exceed the $237,000 figure of the 1937 storm. Power was restored in this order: Pumping plants, hospitals, refrigerator plants and war plants, and other emergency consumers, and then residence sections.

Many of the motors had burned out and several days were required to replace entire motors. The reduction in the use of air-conditioning systems in the city further reduced the loads on the lines.

The entire city of Galveston was blacked out by power lines broken and the roof torn from a stand-by electric plant. Lights came on the next day, however, and some lights were on Tuesday night. At Goose Creek W. C. Swain, manager of the Houston Lighting & Power Co., pulled the switch at 2 p.m. to black out that area. Lights were out in portions of the Tri-Cities area for several days and telephone service was disrupted even longer.

Communications Out

Three hundred long-distance telephone poles were snapped off like matchsticks, one after another, and six inches of water overlaid the wires, between Houston and LaPorte. All communicating lines to the Tri-Cities, Galveston, Crosby, Beaumont, Mt. Belvieu went out when the storm hit. Service to Tri-Cities was resumed Thursday by use of two telephone circuits for preferred calls; service to LaPorte and Texas City was still out; four lines were open to Galveston, which was neither receiving nor dispatching mail, but for priority rated calls. All calls to Dallas and Fort Worth were delayed up to six hours. Pasadena, late Thursday, was the only outlying community with



SECOND PIT NO. 5 VALVE—The second control valve in Pacific Gas & Electric Co.'s new Pit No. 5 power house was shipped recently by its builder, Joshua Hendy Iron Works. The first is already installed and the remaining two will go out in the early fall. The valves are hydraulically operated from penstock pressure

its trunk line restored. The delay to telephone service to Tri-Cities was due to the fact that the exchange is operated on current from the Houston Lighting & Power Co., with a battery for emergency power, which is saved for emergency war calls or others of like high priority.

Houston radio stations suffered early in the evening. The power failed at KTRH at 1:30 p.m. Tuesday and the station was cut off from its station beyond Goose Creek. B. F. Orr, station manager, reported the loss of two big towers and two towers remaining in operation. No damage was sustained by the building nor the transmitter, but service was disrupted due to the necessary wire repairs by the Houston Lighting & Power Co. KPRC and KXYZ went out at 3:30 p.m. when the antennæ and tower at their Deepwater plant were leveled. Emergency crews made repairs immediately to KXYZ, which was the only station operating Thursday.

OCD Helps Out

More than 10,000 OCD volunteers were called out in the emergency and were credited with saving the lives of many injured persons, fighting fires and guarding broken power lines.

Power failure caused the shutdown of 24 artesian wells serving water consumers in Houston, and five of the city's water pumping plants were out of operation, leaving the community facing an acute water shortage.

When the power went off, the new plant of the General Tire & Rubber Co. had all its electrical heating and automatic control units put out of commission; batches of rubber hardened in vats, tanks and containers and had to be chipped out by hand.

Two 300-foot steel towers carrying power across the ship channel near Baytown, built to withstand winds of 120 miles an hour, were blown flat.

H. J. Corcoran, district WPB manager, said that the district office was granted authority to grant priorities directly for all needed repairs.

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Storm Cuts Ohio Edison Service

All power plants of the Ohio Edison Co. in the Youngstown, Ohio, district were knocked out of service in an electrical storm at 6:30 p.m. Tuesday, July 27, which halted industrial production and tied up transportation for 40 minutes. The Toronto and Lowellville plants of the company as well as the Pennsylvania Power Co. plant at New Castle, Pa., were shut down and all interconnections with other power company lines were interrupted in what was considered the worst storm from the power company's viewpoint in its history. Officials said lightning apparently struck relays between consuming areas and generators at the power houses, resulting in steam piling up until safety valves blew off at generating plants.

It was 9 p.m. before the Toronto plant was back in operation, but in the meantime current was switched in from the Ohio Public Service Co. power plants, so that some supply was available to Youngstown by 7:35 p.m. and for other areas soon thereafter. Also affected were New Castle, Ellwood City, Sharon, Farrell, Salem and adjacent territory.

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Northern Indiana Named on "Write-Ups"

The Federal Power Commission recently directed the Northern Indiana Public Service Co. to show cause within 30 days why it should not be ordered to dispose of more than $9,000,000 in "write-ups" and other amounts representing excess over original cost.

In detail the order directs the company to show cause why it should not be directed to (1) establish $9,366,681.96 in its electric, gas and common plant adjustments accounts (account 107) and $131,990.66 in its electric and gas plant acquisition adjustments accounts (account 100.5); (2) submit plans for the disposition of $7,761,277.71 of the $9,366,681.95, described by the FPC as representing excess arising through purchase of property from associated companies, $2,419,342.97 of which is established in account 107, electric plant adjustments, and $5,341,934.74 in account 107, gas plant adjustments; (3) submit plans for the disposition of the $131,990.66, of which $4,182.34 is established in account 100.5, electric plant acquisition adjustments and $127,808.32 is established in account 100.5, electric plant acquisition adjustments and $127,808.32 is established in account 100.5, gas plant acquisition adjustments; (4) dispose of $1,605,404.24 of the $9,366,681.95, established by FPC in account 107, electric gas and common plant adjustment accounts, in accordance with the dispositions recommended by the commission's staff.

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Utility Coal Consumption

Electric utility power plants consumed 6,289,381 tons of coal in June, the Federal Power Commission reports. Coal stocks of electric utility power plants as of July 1 were 12.6 percent over the same date last year.

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Interior Gets Power From Three Dams

By executive order President Roosevelt has transferred to the power division of the Interior Department control of power generated by Denison Dam in Texas, Grand River Dam Authority (Pensacola project) in Oklahoma and Norfork project in Arkansas and Missouri. The Interior Department will take over responsibility for distribution of power from the three dams on September 1. Denison and Norfork projects are still under construction and are expected to start generating electric power early next year. Grand River Dam Authority, formerly an Oklahoma state project, already is producing.

With respect to Denison Dam, the executive order directs the Secretary of the Interior to dispose of electric energy to war plants and establishments, public bodies, co-operatives, and other persons, in that order of preference at such rates as may be approved by the Federal Power Commission. Denison Dam will continue to be operated so far as the production of energy is concerned by Army engineers, as will Norfork.

The Norfork project and Grand River Authority were transferred by the executive order from the Federal Works Administrator to the Interior Department. Norfork was placed under supervision of FWA on June 19, 1943, and Grand River was placed under FWA on November 19, 1941.

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Johnson Succeeds Volkhardt at WPB

Chairman Donald M. Nelson has announced the appointment of Roy W. Johnson as Director of the Facilities Bureau, succeeding Charles E. Volkhardt. Mr. Johnson has been deputy director of the bureau since the first of July. Mr. Volkhardt, who came to WPB in April, left to resume his work as executive vice-president of Harvey Hubbell, Inc., of Bridgeport, Conn.

The new director came to WPB in December, 1942, to serve as executive assistant to Ralph J. Cordiner, then Director-General of War Production Scheduling. Before coming to WPB he was associated for three years with Schick, Inc., of Stamford, Conn., and before that for nine years with the General Electric Co.

No Change Forthcoming in WMC "Essential" Listing

Recommendations of Council of Electric Operating Companies already covered in existing bulletin of occupational classifications, commission holds — Bartlett plan for repairman "pool" given consideration

Efforts of the Council of Electric Operating Companies to recommend changes in the interpretation of Selective Service classifications of certain groups in the utility industry have resulted only in the War Manpower Commission's advice to utilities to participate in the Manning Table and Replacement Schedule Programs of WMC, according to Tom P. Walker, president. Inclusion of an activity or ocupation in a WMC bulletin, William Haber of the commission said, does not assure occupational deferment; likewise, exclusion of an occupation from a bulletin does not preclude consideration for deferment from military service. Subject to the right of appeal, the classification of a registrant is determined on an individual basis by the local board, upon consideration of all the evidence submitted.

The COEC's recommendations had to do with WMC's classification of "functional administrative assistant," "accountant, administrative," and "electric meter-repair." The former, it was said, is covered by the qualifying statement appearing under "manager or superintendent." Nor does this mean, Mr. Haber pointed out, that managers or their assistants concerned with legal, tax, insurance and rate structure problems will be denied consideration for occupational deferment solely because they are not included on the list. The latter two, Mr. Haber indicated, were already sufficiently under "accountant, audit" and "electric-meter tester."

The last issue of CEOC "Notes," incidentally, reports that 40 percent of utility companies are using replacement schedules; 25 percent plan to use them, and 35 percent do not use them and have no plans to do so.

New Method Suggested

In the meantime WMC and Selective Service are said to be considering the possibility of handling the supply of skilled electric repair and service men by areas, whereby the local electric company would sponsor group replacement schedules covering all service men in the area eligible for occupational deferment.

The idea has been promoted vigorously in Washington by J. S. Bartlett, managing director of the Electric Institute, and, if the plan is adopted, Washington might serve as a proving ground for other sections. Under the plan as suggested for Washington, all Potomac Electric Power's service men and those of appliance dealers in the Washington area would be handled under the same program and replacement schedule, drawn up and supervised by Pepco. Chief aim would be to keep a satisfactory pool of repair and service men in the area. The utility would be repaid for its efforts by the assurance that existing appliances would stay on the line, thus contributing to customer satisfaction.

Bartlett's three-point program includes:

1. Filing replacement schedules for repairmen as a whole in the area.

2. Where WMC has been unable to help, the Office of Civilian Requirements can investigate the possibility of a local recruiting drive to furnish the necessary workers or apprentices.

3. Where WMC certifies that there exists no supply of service and repair labor in the area, the industry can petition the War Labor Board and OPA for wage and price adjustments which would allow the industry to compete for the available labor supply.

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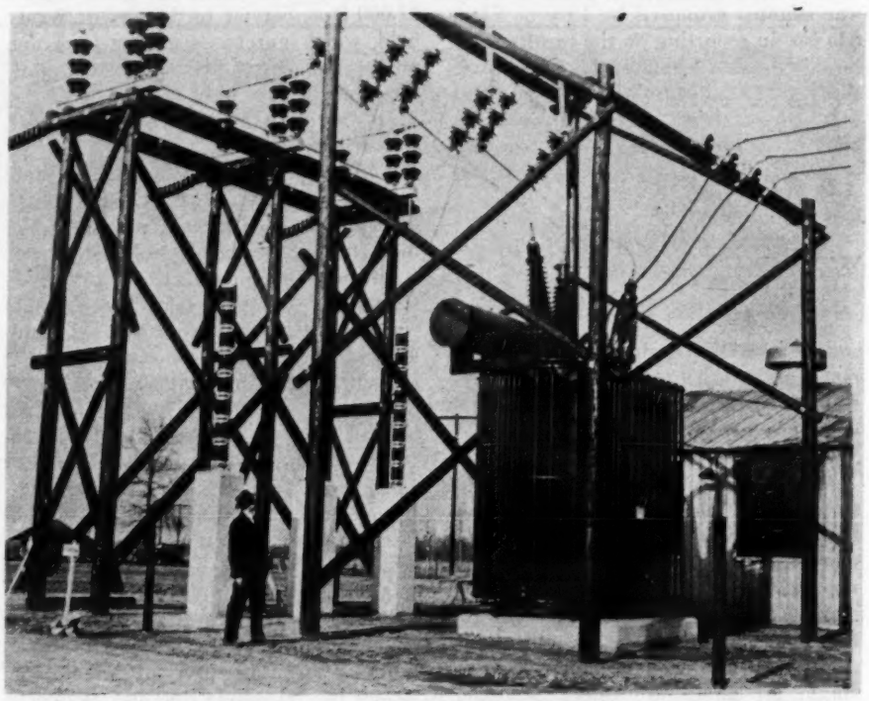
N. Y. Adopts Idle Appliance Resale Plan

More than 500,000 idle electric appliances are expected to be made available in New York City within the near future through a program initiated August 2 by appliance dealers in the metropolitan territory, co-operating with the Consolidated Edison System companies. Under the plan, originally sponsored by the Proctor Electric Co., persons with appliances not being used—either in workable condition or capable of repair—may exchange them for war savings stamps.

The proposed program stems from a survey made by the power company among hundreds of housewives to find out what unused electrical equipment they would be willing to relinquish to alleviate the shortage of such items due to the ban on production of civilian consumer goods. The 500,000 appliances—with irons and toasters predominating—indicated as available for turn-in by the survey will be resold to the



WOOD ON THE "BIG INCH"—Wood substitutes for steel as superstructure for this outdoor substation at Station 7 on the "Big Inch" pipeline in Arkansas. Power transformer shown is a General Electric three-phase, 60-cycle-unit, 3,750 kva., 110,000 to 2,400 volts

public at prices to be set by the dealers. Turn-in prices will be arrived at by agreement by the dealer and the housewife with the appliance to sell.

At the beginning of this year, according to N. T. Sellman, assistant vice-president in charge of sales for the company, Consolidated Edison made a survey of dealers' shelves, finding on hand some 50,000 appliances, and thereafter directed customers to dealers with equipment in stock. These supplies are virtually liquidated today. The new plan will be announced in August bill inclosures, showroom and truck posters and in advertising material furnished to co-operating dealers.

Blackstone Valley Tries Plan

Results from the first advertisement of the Blackstone Valley Gas & Electric Co. offering $1 in war stamps for every old electric flatiron brought in, plus a 25-cent stamp for the cord, were 30 irons in four days, with more coming in. Of these first irons received about 65 percent were in operating condition and can be resold after only a little cleaning up and polishing. Of the remainder only a few were beyond repair; most of them can be fixed up with salvaged parts without much difficulty. Nearly half the irons brought in were accompanied by cords, nearly all of which are usable with a little reconditioning.

This first advertisement was somewhat in the nature of a test of the idea of swapping old appliances for war stamps, proposed by Proctor Electric Co. In reporting on the results from the first advertisement, M. H. North, Blackstone Valley sales executive, said that the activity, having proved its merit, would now be promoted vigorously.

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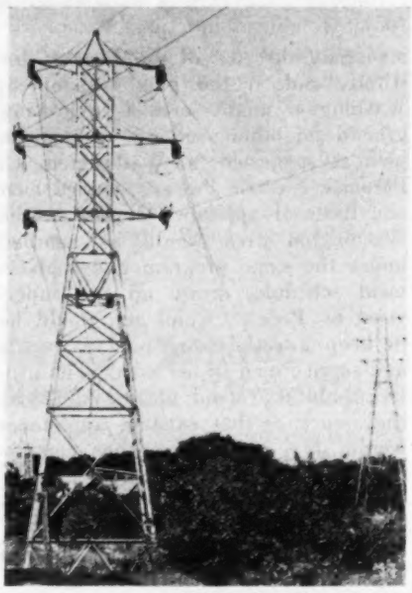
WPB Tightens Steam Turbine Specifications

Specifications designed to conserve materials in the construction and installation of steam turbines for land use were issued last week by WPB in Schedule VI to Order L-154.

The order provides that no producer shall install on any steam turbine for land use, with some exceptions, sheet metal lagging, asbestos or other high-temperature molded insulation, ornamental trim, gage equipment larger than the minimum practicable size, duplicate instruments, more than a single oil pump or tubing or other special materials not customarily furnished by the manufacturer for the conditions under which the turbine is to operate.

Army Plane Survives Striking 66-Kv. Line

Two 66-kv. transmission circuits of the Western Massachusetts Electric Co. at Westfield were struck by a Republic P-47 Thunderbolt army plane at 9:34 a.m. July 19 and put out of service for eight hours 18 minutes, without known injury to the pilot, although the plane itself was reportedly damaged. At the time the line was acting as an auxiliary tie and was carrying a load of about 12,000 kva. Service to the city of Westfield, which purchases energy from the utility and distributes it locally, was interrupted for only twelve minutes while the necessary switching and load transfers took place.



Robinson News Photo, Westfield

VIEW OF LINE after being hit by plane

The power conductors of the line consisted of No. 3/0 A.C.S.R. cable, with an overhead ground wire of ⅜-in. high-strength stranded steel. Below was a two-wire telephone circuit of three-strand, No. 9 copperweld. The damage was done between towers Nos. 423 and 424, which are angle towers on a river crossing span 765.5 ft. long. The phase wires were 50, 60 and 70 ft. above the ground base, the ground wire being 75 ft. above the base and the telephone line 39 ft. from ground. The wires burned down in mid-span, at which point the mean water level is 14 ft. below the base line. It is uncertain at this writing which wires were hit by the plane or the exact cause of the burnout. One theory is that an antenna or some other protruding part of the plane struck the telephone line and caused it to snarl up with some of the other conductors, and another that it was due to distortion result from backwash or partial vacuum created by speed of plane.

North American Votes to Liquidate

Directors of the North American Co., second largest holding company system in the country, voted this week to submit a plan to the Securities and Exchange Commission aimed at dissolving the business in compliance with "death sentence" provisions of the Holding Company Act. The action was taken despite the fact that North American still has pending before the U. S. Supreme Court its appeal from a Circuit Court decision upholding an SEC order requiring company's dissolution.

Revealing the submission of the new plan, Edward L. Shea, president, also disclosed that North American had completed arrangements with a group of banks for a five-year loan, aggregating $34,881,500, at 2 percent interest rate, proceeds of which would be used to retire immediately all of the company's outstanding 3¾ and 3½ percent debenture indebtedness at current redemption prices plus accrued interest. North American's divestment plan calls for the company disposing of its utility investments by means of retiring of senior securities and eventual distribution of its principal investments among holders of its common stock, "with a minimum of sales or other forms of liquidation."

Regional Holding Companies

Four regional holding companies will be set under the plan: Union Regional Co., to hold common stock of Union Electric of Missouri; Ohio Regional Co., to hold the stock of Cleveland Electric Illuminating; Wisconsin-Michigan Regional Co., to hold the stock of Wisconsin Electric Power and a portion of North American's holdings in Pacific Gas & Electric, and North American Regional Co., to hold the stock of Washington Railway & Electric and part of Pacific Gas & Electric common. A fifth company is proposed as a liquidating concern to hold North American Light & Power Co. stock and miscellaneous holdings. This latter company would be jointly owned by the four regional companies.

Division of Assets

North American's assets would be divided among the four regional companies, which would respectively assume the obligations under the bank loan agreement and issue their shares of preferred and common stock, in proportionate amounts, to North American's stockholders. Eventually, upon retirement of indebtedness and preferred stock, the regional companies would be dissolved.

SEC Ruling on Stocks Upheld by Federal Court

Participation of common stock in liquidation of holding company, contrary to bankruptcy technique, established in United Light & Power case — Commissioner Healy dissent overruled

The contention of the Securities and Exchange Commission establishing the right of the common-stockholder of a holding company undergoing dissolution under "death sentence" provisions of the Holding Company Act to participate in the distribution of the assets was upheld last week in the Federal District Court in Wilmington, Del. Approval of the SEC's stand was given by Federal Judge Paul Leahy in the case of the United Light & Power Corp.'s dissolution plan, which the commission asked the court to enforce.

Healy Dissent Over-ruled

In affirming the right of the owners of the "under water" common stock to share in the assets of the corporation along with the owners of preferred stock, even though the interest of the common stock in earnings was remote, the court upheld the majority opinion of the commission, and ruled out the dissenting opinion of Commissioner Robert E. Healy, who contended that the bankruptcy technique of "absolute priorities" also held in the case of enforced liquidation of a holding company.

United Light's original voluntary plan to comply with the provisions of the act provided for an 8.8 percent participation of common stock. The SEC subsequently held that figure too high and, in a later amendment to its plan, United provided for a 5.48 percent participation for the common, against a 94.52 percent allocation for the preferred, which the commission approved. Mr. Healy took the view that the common-stock interests were entitled to nothing, since the liquidating demands of the preferred would absorb all the assets.

The amended plan of United Light & Power provides in substance for the contribution of cash and certain investments of the company to its subsidiary, United Light & Railways Co., for the reclassification of the preferred and common stocks of United Light & Power into a single class of common stock by way of distribution of all the common stock of United Light & Railways in the aforementioned ratio of 94.52 percent to Power's preferred—and 5.48 percent to its common-stock holders. The plan also provided for the assumption by railways of Power's liabilities, the transfer of Power's remaining assets to Railways and, subsequently, the dissolution of United Light & Power.

There was no real finality to the particular dissolution, Judge Leahy said, because "Power's shareholders simply transform themselves into holders of common stock of Railways and thus obey the demands of Congress." The present plan, he added, must be considered litle more than a reclassification.

Pointing out that the Holding Company Act marked a radical departure from all previous legislation, Judge Leahy declared that:

"The dominant purpose of the Bankruptcy Act is the elimination of claims without value, whereas the dominant purpose of the Holding Company Act is the enhancement of security values through integration for the protection of investors. Unless the financial condition of such company is such that it faces liquidation apart from the necessity to comply with the statute, the bankruptcy interpretation of 'fair and equitable' does not apply."

•

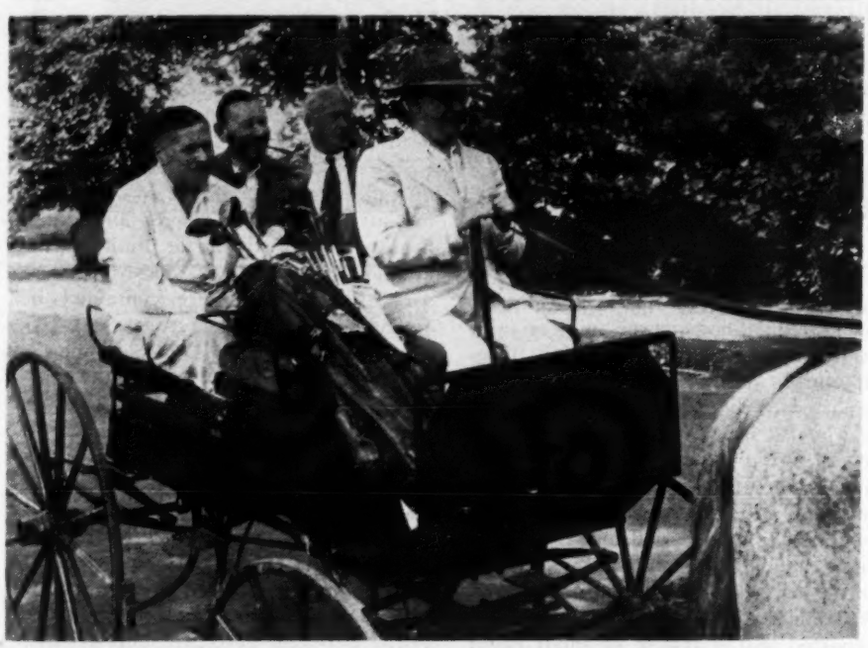
White River Dam Tests Completed

Preliminary engineering work and foundation tests for the Bull Shoals Dam on White River in Baxter and Marion counties, Arkansas, and the Table Rock Dam on White River in Taney County, Missouri, have been completed. Both dams have been projected as power and flood control projects.

It has been estimated that 619,000,000 kw.hr. of power could be produced annually from the two dams, of which 344,000,000 would be firm power.

A proposed dam 223 feet high and 2,000 feet long has been projected at Bull Shoals. It would have a flood control storage of 2,155,000 acre-feet and power storage of 595,000 acre-feet. Initial installation of generation for 140,000 kw. has been proposed.

Table Rock Dam has been proposed as 206 feet high and 2,000 feet long, with 485,000 acre-feet of storage for flood control and 1,200,000 acre-feet for power. Initial installation of 140,000 kw. of capacity is proposed here.



OATSMOBILE PILOT—President C. L. Campbell, Connecticut Light & Power Co., refuses to let wartime restrictions on automobile driving stymie his birthday celebration with three friends who have golfed with him on each anniversary for 17 years. Irwin W. Day, retired vice-president of the C.L.&P., and a member of its directorate, looks on approvingly from the middle of the back seat

Bashore Appointed Reclamation Head

Harry W. Bashore, Assistant Commissioner of Reclamation since 1939, has been appointed by President Roosevelt as Commissioner of Reclamation, succeeding John C. Page, who resigned recently because of ill health, according to an announcement by Harold L. Ickes, Secretary of the Interior.

Filling Mr. Bashore's shoes in his old job as assistant is William E. Warne, former director of information for the Bureau of Reclamation, the announcement said, and Robert W. Horton, a special assistant to Secretary Ickes, has been appointed to Mr. Warne's old post as director of information.

Mr. Bashore, the new appointee to the commissionership, has been with the Bureau of Reclamation for 37 years. He began his engineering career in 1906 as a surveyor with the B. & O. Railroad and, in a few months joined the bureau in a similar capacity on the North Platte project. In 1918 he became construction engineer of the project and, in 1924, superintendent of the completed and operating project. Three years later he was transferred as construction engineer on the Vale project in Oregon. When that job was finished, in 1930, he went to Spokane to make engineering investigations that preceded the work on the Grand Coulee Dam. Other jobs included work on the Central Valley project and the Casper-Alcova (now Kendrick) project in Wyoming, where he remained as construction engineer until his transfer to Washington as Assistant Commissioner of the Bureau.

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Farmers Getting More Small Motors

A substantial increase in the number of fractional-horsepower motors now being shipped to farm equipment manufacturers and direct to farmers was reported to the War Production Board at a recent industry advisory committee meeting. Both May and June shipping figures show a decided upward trend, but total capacity to produce continues to retain a margin sufficient to replace some small motors that have worn out in use on civilian home appliances, etc.

Committee members of the industry reported that a system of small motor replacement had been perfected that would replace worn-out motors with repaired or rebuilt units. However, the WPB strongly urged that local repair facilities be maintained to ease the burden of shipping motors to and from factory sources.

The meeting was under the chairmanship of R. C. Hanna, chief, fractional-Horsepower Motor Section, General Industrial Equipment Division, WPB.

•

Wire, Cable Prices May Be Adjusted

Provisions for the individual adjustment of ceiling prices for producers and sellers of wire, cable and cable accessories, similar to adjustment provisions recently made available to manufacturers of essential machinery, have been announced by the Office of Price Administration.

The action, contained in amendment No. 4 to Revised Price Schedule 82, which became effective August 4, 1943, is confined to cases qualifying under rigid tests of essentiality of the seller and the product, OPA announced. The tests of essentiality are specified in the amendment, as are various cost, price and competitive data factors which OPA will consider in reviewing the applications for adjustment.

Generally, the new provisions will permit OPA to adjust prices after it has ascertained that ceiling prices are at such a level that supply of vital wire or cable is impeded or threatened.

•

Relax Order on Domestic Appliances

To take care of essential civilian needs, the War Production Board last week authorized restricted production of replacement parts for domestic heating furnaces, stoves, ranges and water heaters and provided for limited production on these items wherever necessary. The orders were contained in amendments to L-22 (furnaces), L-185 (water heaters) and L-23-c (domestic cooking appliances and domestic heating stoves).

Furnace production was placed directly under CMP and the order requires that furnaces shall be delivered only on orders rated A-10 or higher. In addition, the order provides for further simplification of the furnaces produced and a limitation on the number of models which may be manufactured. Furnace repair parts are unrestricted.

The amended Order L-23-c removes quota restrictions from individual manufacturers, but specified the quantity of stoves that may be produced by the industry as a whole. The number of models and types of cooking appliances produced are also specified.

On water heaters, Order L-185 permits manufacture based on a percentage of similar equipment produced in 1941.

MEETINGS

Previously Listed

International Association of Electrical Inspectors—Northwestern section, New Washington Hotel, Seattle, Wash., August 26-27; F. D. Weber, secretary, P. O. Box 70, Portland, Ore. Southwestern section, Los Angeles, Calif., week of August 30; H. L. Gerber, secretary, Room 205, City Hall, San Francisco, Calif. Western section, LaSalle Hotel, Chicago, Ill., September 13-15; F. H. Moore, secretary, 320 N. Meridian St., Indianapolis, Ind. Eastern section, New York, N. Y., week of September 20; F. N. M. Squires, secretary, 85 John St., New York, N. Y. Southern section, Roosevelt Hotel, New Orleans, La., September 27-29; C. M. Jones, secretary, 307 Trust Co. of Georgia Bldg., Atlanta, Ga.

American Institute of Electrical Engineers—National technical meeting, Salt Lake City, Utah, September 2-4. H. H. Henline, national secretary, 33 W. 39th St., New York, N. Y.

National Association of Railroad and Utilities Commissioners—War conference, Edgewater Beach Hotel, Chicago, Ill., September 14-15. Ben Smart, secretary, 7411-13 New Post Office Bldg., Washington, D. C.

Municipal Electric Utilities Association of New York State—Annual conference, Lake Placid Club, Lake Placid, N. Y., September 15-17. T. J. McKee, secretary, 200-212 East Third St., Jamestown, N. Y.

International Association of Electrical Leagues—Annual conference, Netherland Plaza Hotel, Cincinnati, Ohio, September 16-17. O. C. Small, secretary, 155 East 44th Street, New York, N. Y.

Pennsylvania Electric Association—Annual meeting and business conference, Wm. Penn Hotel, Pittsburgh, Pa., September 23. A. B. Millar, managing director, State Street Bldg., Harrisburg, Pa. Electrical equipment committee, Benjamin Franklin Hotel, Philadelphia, Pa., October 14-15. A. N. Shealy, chairman, Pennsylvania Water & Power Co., Lexington Bldg., Baltimore, Md.

International Municipal Signal Association—War conference, Hotel Statler, Cleveland, Ohio, September 27-29. Irvin Schulsinger, secretary, 8 East 41st St., New York, N. Y.

Association of Iron and Steel Engineers—Annual meeting, Wm. Penn Hotel, Pittsburgh, Pa., September 28-30. Brent Wiley, managing director, Empire Bldg., Pittsburgh, Pa.

American Society of Mechanical Engineers—Joint meeting with Engineering Institute of Canada, Royal York Hotel, Toronto, Ont., Canada, September 30-October 2. Annual meeting, Pennsylvania Hotel, New York, N. Y., November 29-December 3. Ernest Hartford, executive assistant secretary, 29 West 39th St., New York, N. Y.

National Safety Council—Congress and exposition, Sherman Hotel, Chicago, Ill., October 5-7. N. H. Dearborn, managing director, 20 N. Wacker Drive, Chicago, Ill.

National Electrical Contractors Association—Drake Hotel, Chicago, Ill., October 10-11. L. W. Davis, general manager, 633 Investment Bldg., 15th and K Sts., N.W., Washington, D. C.

Electrochemical Society—Fall meeting, Pennsylvania Hotel, New York, N. Y., October 13-16. Colin G. Fink, secretary, Columbia University, 3000 Broadway, New York, N. Y.

American Welding Society—Annual meeting, Hotel Morrison, Chicago, Ill., week of October 18. Miss M. M. Kelly, secretary, 29 West 39th St., New York, N. Y.

Engineers Council for Professional Development—Annual meeting, Engineering Societies Building, New York, N. Y., October 23. A. B. Parsons, secretary, 29 West 39th St., New York, N. Y.

National Electrical Manufacturers Association—Annual meeting, Waldorf Astoria Hotel, New York, N. Y., October 25-29. W. J. Donald, managing director, 155 E. 44th St., New York, N. Y.

Joint Fuels Conference—American Institute of Mining Engineers and American Society of Mechanical Engineers—Wm. Penn Hotel, Pittsburg, Pa., October 28-29. T. E. Purcell, chairman, Duquesne Light Company, 435 Sixth Ave., Pittsburgh, Pa.

Last July Week Output Again Rises

Maintaining its steady upward march to new record levels, the output curve again advanced more than seasonally during the week ended July 31, according to figures released by the Edison Electric Institute. Figures for the latest week on the amount of electrical energy distributed by light and power companies totaled 4,226,705,000 kw.-hr., compared to 4,196,357,000 kw.-hr. the week previous and 3,649,146,000 kw.-hr. for the corresponding week a year ago. The latest week's figures represent an increase of 15.8 percent over the 1942 week.

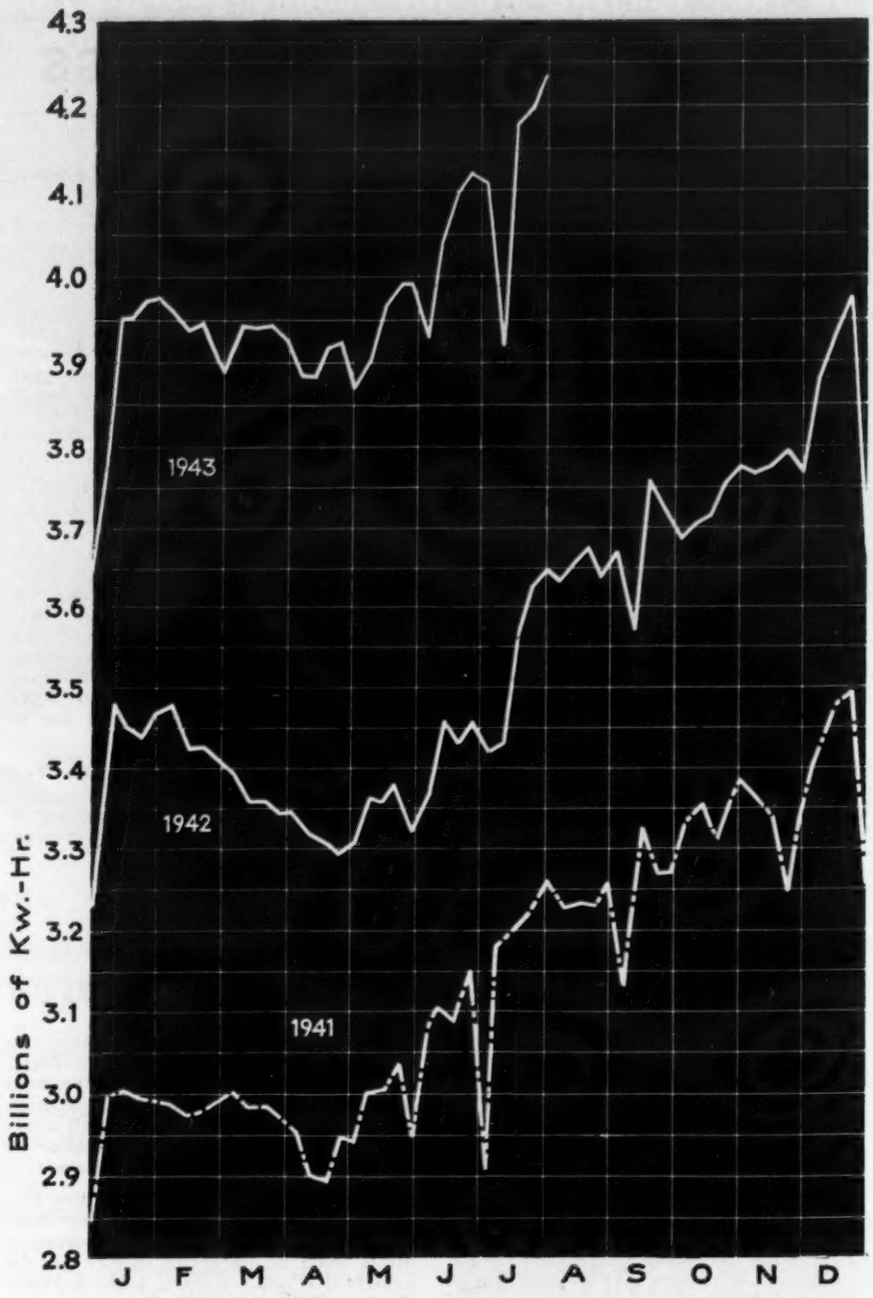
Five of the seven major geographic regions of the country contributed to the latest week's rise, the two declining being the New England region, which dropped from a 9.3 percent increase over '42 to a 6.7 percent increase, and the Southern States, which went from a 17.6 percent rise to 16.0 percent rise. The Pacific Coast area continued to lead the country in gains over last year with 21.1 percent increase.

Weekly Output, Million Kw.-Hr.

1943		1942		1941	
July 31	4,227	Aug. 1	3,649	Aug. 2	3,263
July 24	4,196	July 25	3,625	July 26	3,220
July 17	4,184	July 18	3,565	July 19	3,199
July 10	3,919	July 11	3,429	July 12	3,178
July 3	4,110	July 4	3,424	July 5	2,901
June 26	4,120	June 27	3,457	June 28	3,157
June 19	4,098	June 20	3,434	June 21	3,091
June 12	4,040	June 13	3,463	June 14	3,101
June 5	3,926	June 6	3,372	June 7	3,076
May 29	3,990	May 30	3,322	May 31	2,955

Percent Change from Previous Year

	Week Ending		
	July 31	July 24	July 17
New England	+ 6.7	+ 9.3	+11.3
Mid-Atlantic	+17.6	+17.5	+19.0
Central Industrial	+14.1	+13.6	+13.0
West Central	+14.2	+12.3	+13.5
Southern States	+16.0	+17.6	+22.0
Rocky Mountain	+16.5	+10.2	+11.1
Pacific Coast	+21.1	+20.6	+23.4
Total United States	+15.8	+15.7	+17.4



Energy Sales Advance 18.2% in May

Sales of electric energy to ultimate customers in May totaled 14,758,300,000 kw.-hr., compared with 12,487,276,000 kw.-hr., an increase of 18.2 percent, according to the report issued by the Edison Electric Institute.

Of a total generation of 17,858,663,000 kw.-hr. for May, generation by water power plants accounted for 7,196,513,000 kw.-hr., a gain of 34.3 percent over the water power generation for May, 1942.

Revenue from ultimate customers amounted to $246,789,000 in May, compared with $225,601,800 in the similar month of 1942, an increase of 9.4%.

For the twelve months ended May 31, the average annual use advanced to 1,037 kw.-hr. per customer from 1,008 kw.-hr. per customer, an increase of 2.9 percent; average annual bill to $37.95 from $37.30, an increase of 1.7 percent; revenue per kilowatt-hour dropped to 3.66 cents from 3.70 cents, a decrease of 1.1 percent.

Classification of Sales, May, 1943 and Change from 1942

Kilowatt-hour sales—During month of May	Million 1943	Kw.-Hr. 1942	% Change
Residential or domestic	2,240	2,047	+ 9.4
Rural (distinct rural rates)	218	216	+ 1.4
Commercial or industrial			
Small light & power	2,307	2,124	+ 8.6
Large light & power	8,458	7,062	+ 19.8
Street and highway lighting	148	143	+ 3.2
Other public authorities	732	305	+140.0
Railways and railroads			
Street & interurban	370	333	+ 11.1
Electrified steam	206	187	+ 9.9
Interdepartmental	78	69	+ 13.2
Total to ult. customers	14,758	12,487	18.2

Energy Production Hits New High in June

Electric energy produced for public use in June totaled 17,832,604,000 kw.-hr., an increase of 19.3 percent over production in June, 1942, and the highest monthly production on record, the Federal Power Commission reports.

SEC DECISIONS - HEARINGS

The Securities and Exchange Commission, in a new series of orders issued during the past week:

CONDITIONALLY APPROVED the application of Northern Indiana Public Service Co. for exemption from the provisions of Section 6 (a) of the Holding Company Act in the issuance and sale of $45,000,000 principal amount of first mortgage bonds, series C, dated August 1, 1943, and maturing August 1, 1973. Approval was made subject to further commission order after the terms of the financing have been determined by competitive bidding, and to a charge against income for each calendar year of at least $1,936,000 as provision for depreciation.

APPROVED THE TERMS of the issuance and sale by South Carolina Electric & Gas Co., subsidiary of General Gas & Electric Corp., of $20,000,000 principal amount of first mortgage bonds, due 1973, on the receipt of a report from South Carolina that it had accepted the bid of a group of underwriters to market the bonds.

TOOK UNDER ADVISEMENT a request of the city of Port Arthur, Texas, that the commission find that the proposed acquisition of Peoples Gas Co. by Texas Public Service Co. from Consolidated Electric & Gas Co. failed to meet the qualifications of the Holding Company Act. As an alternative, the commission was asked to defer action on the proposal pending the vote of the Port Arthur electorate on August 12 on a $2,100,000 bond issue to enable the city to buy the property. The proposal for Texas Public Service to buy Peoples Gas was originally contained in an amendment to a plan of reorganization, filed last June by the Peoples Light & Power Co., the parent concern.

APPROVED DONATIONS by Consolidated Electric & Gas Co., aggregating approximately $2,789,310, to its subsidiary holding company, the Islands Gas & Electric Co. Of the total, approximately $1,417,000 in cash would represent the estimated amount of tax saving to the parent system resulting from a war loss taken with respect to the Philippine investments of Islands Gas & Electric. Approved also was the plan of Islands to acquire and retire bonds, presently held by Consolidated, in the face amount of $2,143,500, through the issuance of new bonds; the right of Islands to apply $800,000 of the cash donated by Consolidated, together with other funds, to redeem and retire the publicly held bonds of the subsidiary; the extension of one year, until August 1, 1944, of the exemption of Islands and subsidiaries from certain provisions of the Holding Company Act.

PERMITTED TO BECOME EFFECTIVE the declaration filed by Interstate Power Co. of Delaware, subsidiary of Ogden Corp., covering its proposal to settle and adjust the intercompany open account indebtedness of $252,567 owed to it by its wholly owned subsidiary, Interstate Power Co. of Wisconsin. Under the plan the Wisconsin company will pay to the Delaware company $52,567 in consideration of the forgiveness of the balance of $200,000, ordered by Wisconsin Public Service Commision to be carried on the subsidiary's books as a credit to capital surplus, and used by it to absorb adjustments after original cost of its utility plant is finally determined.

GRANTED PERMISSION to Suburban Gas & Electric Co. to issue and sell 25,120 shares of additional $25 par value capital stock at $31.25 a share. The shares are to be offered to stockholders of the company, a subsidiary of North Boston Lighting Properties in the New England Power Association system. Proceeds will be used to pay Suburban Gas indebtedness to the parent concern in the aggregate amount of $785,000, represented by promissory notes maturing July 30.

APPROVED, subject to certain reservations, application of Electric Power & Light Corp. for exemption from the competitive bidding rule of SEC on its proposed sale of 450,000 shares of $20 par value common stock of its subsidiary, Idaho Power Co. Prior to the proposed sale, Electric would make a capital contribution to Idaho consisting of 60,000 of the presently outstanding 150,000 shares of $100 par value common stock of Idaho, held by Electric, and split the remaining 90,000 shares five to one.

EXTENDED THE TIME within which West Texas Utilities Co. may buy the outstanding securities of Pecos Valley Power & Light Co. to August 31, subject to same conditions imposed in original order of January 25.

Applications Filed

During the same period the commission received the following applications and proposals:

JOINT DECLARATION by North American Co. and its subsidiary, Milwaukee Light, Heat & Traction Co., covering the proposal of the latter to distribute as a liquidating dividend, in complete liquidation, all assets held by it on the date of distribution to its sole stockholder, North American.

PROPOSAL OF NY PA NJ Utilities Co., subsidiary holding company in the Associated Gas & Electric Corp. system, to divest itself of its entire interest in the Litchfield (Conn.) Electric Light & Power Co. by the sale of 2,500 shares of no-par common stock to the Connecticut Light & Power Co. for $485,000. Proposed sale is in accordance with an SEC order of August 13, 1943, directing trustees of Associated to dispose of Litchfield.

AMENDED VOLUNTARY PLAN, filed under Section 11 (e) of the Holding Company Act, by Community Gas & Power Co. and its subsidiary holding company, American Gas & Power Co., to comply with the "death sentence" provisions of the act. Plan provides for the recapitalization of American and its ultimate qualification for to do business in Minneapolis, taking the place of its subsidiary, Milwaukee Gas Light Co., and bearing that name. The plan, in addition, provides for the disposal of American's interests in several subsidiaries.

Hearings Scheduled

Hearings on applications, scheduled by the Securities and Exchange Commission during the past week include the following:

AUGUST 13: Hearing on application of Illinois Traction Co., subsidiary of North American Light & Power Co., to sell to the parent 1,500 shares, par value $100 per share, of the common capital stock of its subsidiary Western Illinois Ice Co., for $93,000 in cash. Proceeds will be used to retire preferred stock of Illinois Traction prior to dissolution, and to distribute remainder of proceeds to North American Light & Power as a step in compliance with "death sentence" provisions of the Holding Company Act.

AUGUST 19: Reconvening of the consolidated hearing concerning the Peoples Light & Power Co., including the company's voluntary plan for compliance with the integration provisions of the Holding Company Act and the SEC's order of March 9. Principal step in the plan calls for the merger of the West Coast Power Co. into the California Public Service Co., both being wholly owned subsidiaries of Peoples Light.

SEPTEMBER 8: Consolidated Electric & Gas Co. hearing, postponed at the request of the company from August 3, on application for approval of a plan describing certain proposed steps to effect compliance with Section 11 (b) of the Holding Company Act. The hearing had already been consolidated by the commission with proceedings instituted by them under the same section with respect to Consolidated and Central Public Utility Corp.

Utility Reports

	Net Income 1943	1942
*Arkansas Power & Light	$1,356,994	$1,986,359
*Cleveland Electric Illuminating and subs	6,164,611	6,725,687
*Commonwealth & Southern and subs	13,361,793	11,187,181
*Connecticut Light & Power	3,744,505	3,678,096
*Consolidated Edison (N.Y.) and subs	31,031,443	30,398,815
*Cons. Gas Elec. Light & Power (Balto.) and sub.	6,061,579	6,525,982
*Dallas Power & Light	1,501,865	1,567,669
*Idaho Power	1,477,567	1,063,071
*Louisiana Power & Light	1,384,583	1,014,927
*Mississippi Power & Light	772,483	538,401
*New Orleans Pub. Service	2,263,612	2,210,677
*So. California Edison	9,648,290	11,511,571
*Tampa Electric	1,176,614	1,151,621
*Texas Power & Light	2,563,012	1,403,544

*Twelve months ended June 30.

Jordan Dam Land Cost Called "Excessive"

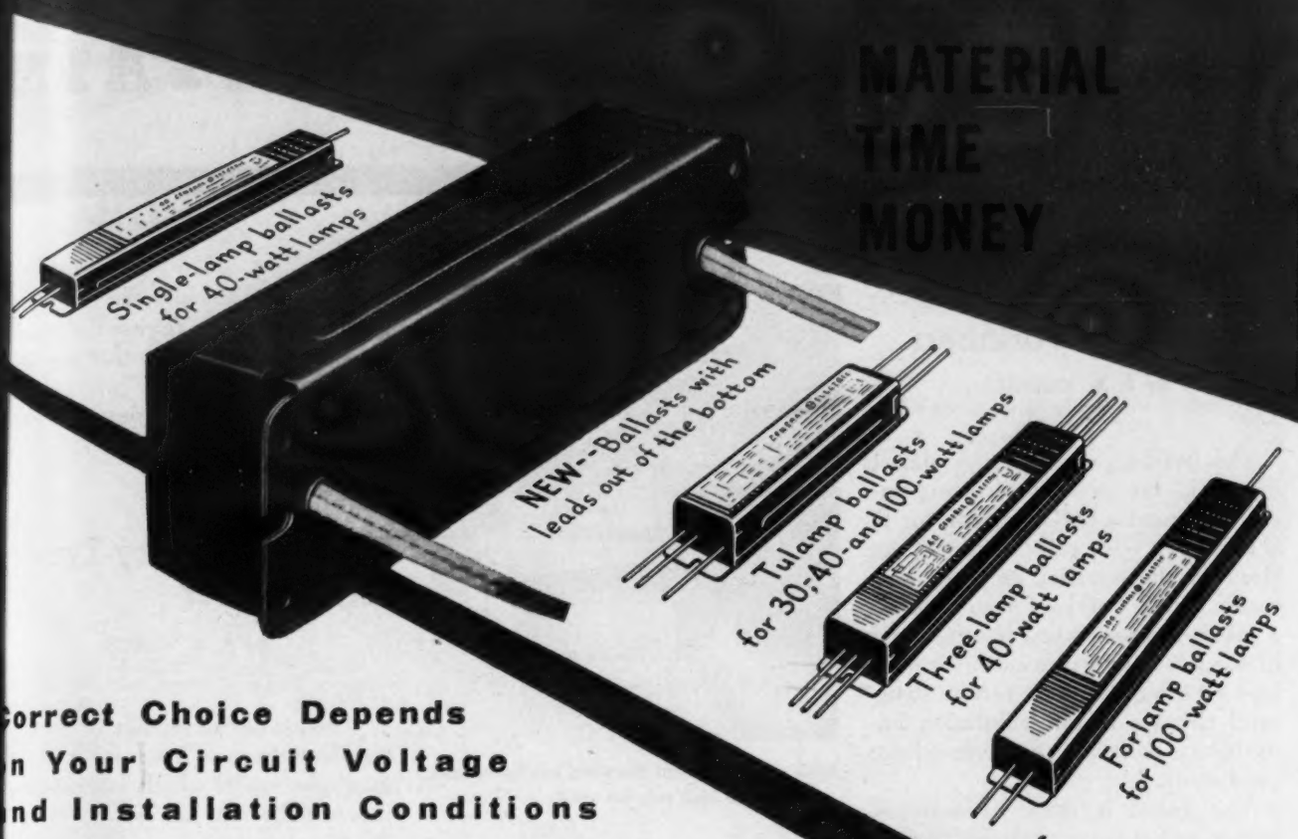
New Orleans Circuit Court of Appeals recently ruled that the $1,000 per acre paid the state of Alabama by the Alabama Power Co. for 600 acres of land on which to build its Jordan Dam project on the Coosa River was "excessive and unreasonable" and not an actual legitimate cost. The decision was made in review of an order of the Federal Power Commission and was made at the instigation of the power company.

The court remanded the matter for a redetermination of legitimate cost.

For War-plant Fluorescent Lighting **CHOOSE THE G-E BALLAST THAT WILL**

SAVE YOU THE MOST

MATERIAL
TIME
MONEY


Single-lamp ballasts for 40-watt lamps
NEW--Ballasts with leads out of the bottom
Tulamp ballasts for 30-40-and 100-watt lamps
Three-lamp ballasts for 40-watt lamps
Forlamp ballasts for 100-watt lamps

Correct Choice Depends on Your Circuit Voltage and Installation Conditions

Single-lamp ballasts—The natural choice for installations requiring but one lamp per fixture; used most often in restricted spaces or where low levels of illumination are sufficient.

Tulamp ballasts—Available for all lamp ratings from 15 watts to 100 watts; conserve materials in the ballast, reduce light "flicker," cut electrical losses, require fewer fixtures for a given-sized installation.

Three-lamp ballasts—Designed for use with 40-watt lamps on all circuits. You avoid use of two ballasts in one fixture, simplifying installations and saving materials.

Forlamp ballasts—For use with 100-watt lamps on 265/460Y-volt circuits; a "natural" for war-plant lighting; does the work of two Tulamp ballasts of the same rating, yet is the same physical size; in one aircraft factory installation, the use of Forlamp ballasts instead of Tulamp saved enough copper to make 95,000 cartridge casings (20-mm) and enough aluminum to make 111,000 fuse primers.

Ballasts with leads out the bottom—The most recent addition to the G-E line; available in 40-watt Tulamp and three-lamp ratings, 100-watt Tulamp and Forlamp ratings; developed as an aid to fixture manufacturers in saving critical materials; can be mounted completely exposed atop a shallow wiring channel.

WRITE TODAY for Bulletin GEA-3293 for complete information on G.E.'s material-saving ballasts for MAZDA F lamps from 4 to 100 watts. General Electric Company, Schenectady, New York.

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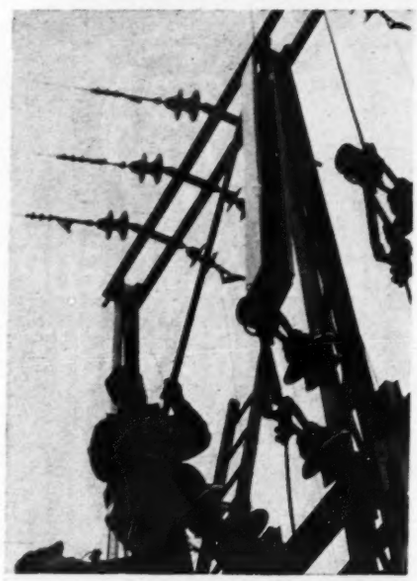
HOW DESIGN... CONSTRUCT OPERATE MAINTAIN

Wire Guard Protects Substation Workmen

By J. B. KENDALL
Wisconsin Public Service Corp., Green Bay

The box-like wooden wire guard shown in the process of being installed around a 13.8-kv. conductor at a Peshtigo, Wis., substation was devised by the hot-stick crew of Wisconsin Public Service Corporation as a safety measure when it was found impossible to interrupt customer service long enough to make certain structural changes at this substation immediately adjacent to high-voltage conductors.

The guard is made of seasoned spruce and is approximately 5 x 6 in. and 8 ft. long, open on one side. Ends are slotted to admit the conductor, which is surrounded on all but one side by the guard. Spring clips hold the guard in place around the wire.



WOODEN wire guard in final position around 13.8 kv., conductor

END of wire guard showing conductor slot, spring lock and release ring

Fashioned from discarded sign-flasher springs, from which the copper had been worn, these spring clips are fastened in the slot opening so that the wire can be admitted to the slot, but not released until a ring is pulled with a hot-line stick to open the slot. Rings were installed in the back of the guard near each end.

Except for the locking device the guard was put together with wooden dowels and given a treatment of hot-line preservative to make it safe for use.

To install the guard over the vertical wire the lower end was slipped onto the conductor first, just above a disconnect switch. With a hot-line tool fastened in the top handling ring on the guard the upper end was raised to the vertical and snapped onto the wire.

To remove the guard a hot-line tool was first fastened in the handling ring to guide the box as it was removed. The top releasing ring was then pulled back, using a tie-stick, thus releasing the upper part of the guard from the conductor. Practically the same procedure was used to release the bottom retaining spring, except that one lineman gripped the box with gloved hands while the releasing ring was pulled back with the tie-stick.

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Redesigned Dry-Type Transformer

By P. A. VANCE
Special Transformer Engineering Division
General Electric Company, Fort Wayne, Ind.

A major design change in dry-type transformers has been incorporated in a new model which was hastened into use by war necessity. Because the transformer is a standard item of equipment, it is important that critical materials be conserved in its de-

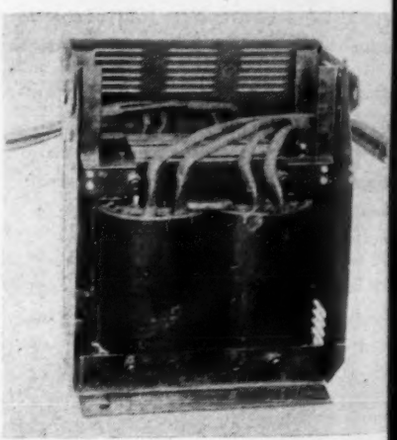


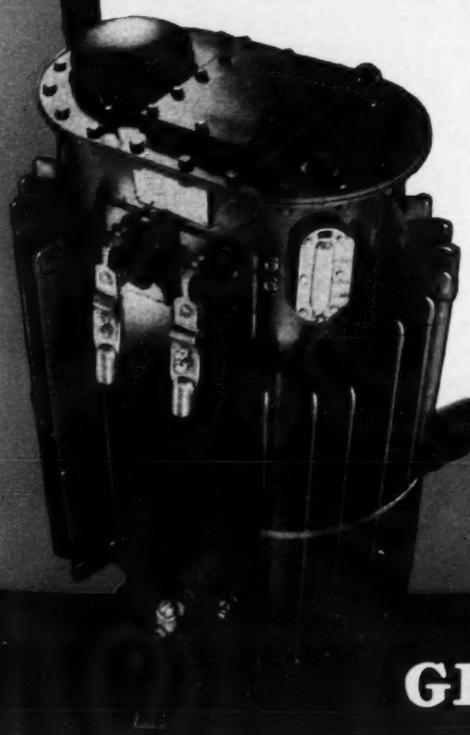
FIG. 1—Core and coil construction of redesigned dry-type natural-draft transformer

sign. Copper saving and other advantages of placing transformers at the load center is demanded by industry. Savings in size and weight permit lighter foundations and require less

Simplify transformer installations with all-purpose PYRANOL transformers

From the one fact that Pyranol* won't burn spring many benefits that would otherwise be difficult to obtain. Since you don't need expensive, fireproof vaults, you can install Pyranol transformers anywhere you wish—in the basement, on overhead beams, on the roof, or on the factory floor *at the center of the load*. Load-center distribution is highly desirable today, of course, because of the great savings in secondary copper that it makes possible. (Also, power losses are less and voltage regulation is 40 per cent better in the usual case.)

And whether the location you choose is indoors or outdoors, above ground or underground, wet or dry, clean or dusty, these *all-purpose transformers* will supply the power for your war loads with little or no maintenance.



*Pyranol is the G-E trade name for askarel, a noninflammable, nonsludging insulating liquid. Ask your G-E representative for Bulletin GES-2974—the complete story for a safer plant. General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

floor space, which may be at a premium.

Unit is essentially a dry-type natural-draft transformer for indoor use on circuits 600 volts and below, and is designated type D. It has a two-legged core, with coils on each leg. Fig. 1 is a front view of the unit. The core is clamped at top and bottom. The bottom clamps provide a base and serve as mounting feet. Top clamps, with suitable vertical members, double for lifting and are also

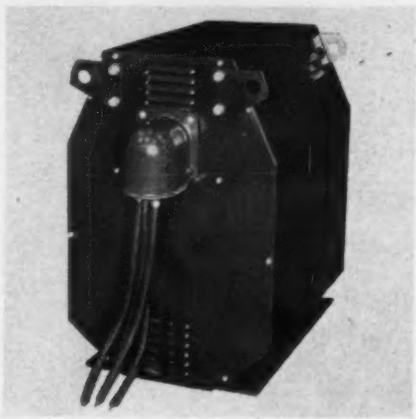


FIG. 2—Exterior of type D transformers, typical of sizes 15 to 100 kva., 230/460–115/230 volts, single phase, 60 cycles

used for the upper bracket when the transformer is wall mounted.

The case has a shape that may appear a bit unusual; upper and lower portions of the side plates recede for very definite reasons (see Fig. 2). Effectiveness of the louvers is improved, mounting feet are exposed and lifting ears are kept within the dimensions of the case. The unit can be mounted against a wall or close to other units, with little or no effect on temperature rise. Air enters the bottom louvers in a vertical direction, passes through the coil ducts and exits at the top with a very small change in direction.

The coils—a large portion of their copper being outside of the core—are exposed for maximum cooling. Primary and secondary coils are concentric and between them there are air ducts that serve as extra insulation and as cooling ducts. Transformers are given a regular production test of 5,000 volts where standard tests call for 4,000 volts.

Two small coils instead of one large coil reduce the mean length of turn, enabling the designer to use more turns of smaller wire for the same copper loss. Open construction mentioned above allows this to be compatible with low temperature rise. Advantages are: More turns mean smaller cores, lower exciting current, and lower inrush current when the primary of the transformer is energized.

Top supports are supplied to prevent any tendency of the coils to shift during unusual conditions and they also hold the end turn solidly to provide a lead anchorage. Cable leads are brazed to the conductors.

The bushing through which the leads issue can be removed and the end of a conduit pipe or fitting inserted. This design is therefore suitable for open or conduit wiring, with or without the conduit outlet. The bushing need not be removed when this outlet is used.

•

Conveyor Carriage Spots Coal on Pile

At the plant of the Orange & Rockland Electric Company, Monroe, N. Y., the coal is handled by a sequence of light and inexpensive belt conveyors. Coal cars are spotted over the hopper, from which a submerged conveyor takes the coal to a crusher. From there a vertical elevator deposits the coal on a cross belt at right angles to the length of the storage pile. The coal is then distributed over the length of the pile by means of a conveyor carriage which can be shifted toward either end of its track; the belt travel can be reversed to dump coal off either end.

Six-inch channel iron rails comprise the track which is supported on wood poles. The conveyor carria is made of angle iron and rides four small industrial-railroad whee Controls for all these conveyors a centered in the crusher house.

From the pile the coal is mov on a subway belt which runs the e tire length of the pile and exten also to the elevator-bucket hous where it is moved to current-use a cumulation in the 175-ton silo. T silo is built of tile and is supporte on high concrete foundations so th the traveling weigh hopper feedin the boiler stokers can pick up i supply by gravity feed.

This coal-handling equipment w made, at an outlay less than $3,00 in the company shops, mostly of scra parts, including material from a abandoned stack. Motors, weighin scales and belts, were practically th only purchased equipments. At th time it was estimated that the smalle equipment purchasable would ha cost more than four times the actu outlay, and even then would ha been too large for the job.

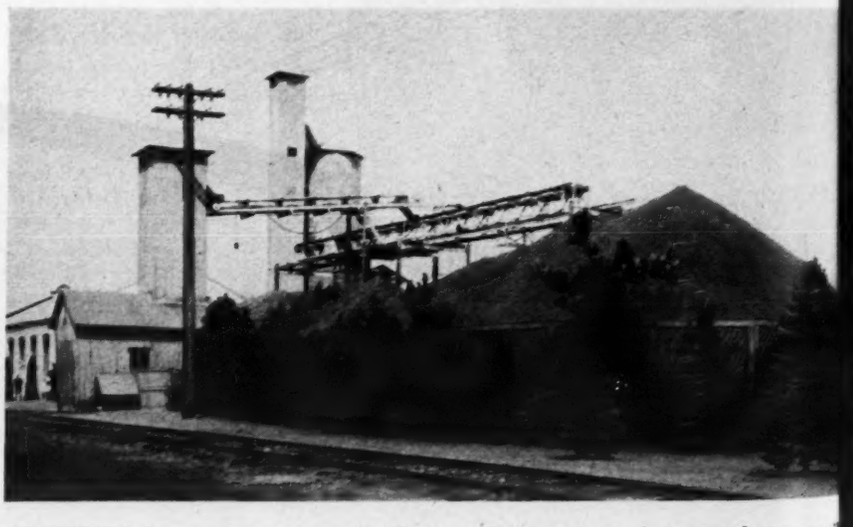
•

Hot-Line Tool Installs Connectors

By J. W. SAMPLE *
Assistant Division Line Foreman,
Kansas Gas & Electric Company, Wichita

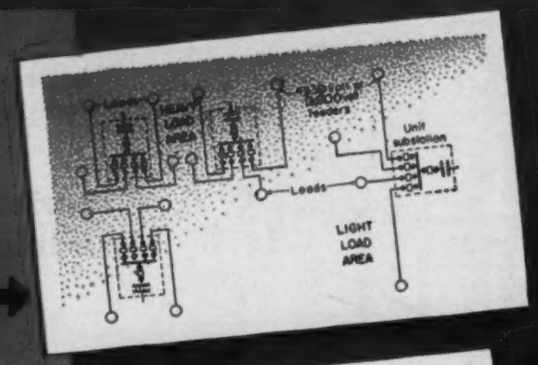
In order to facilitate the install tion and removal of split bolt con nectors from conductors operating a 12,000 volts and above, a hot-lin tool has been designed by the autho

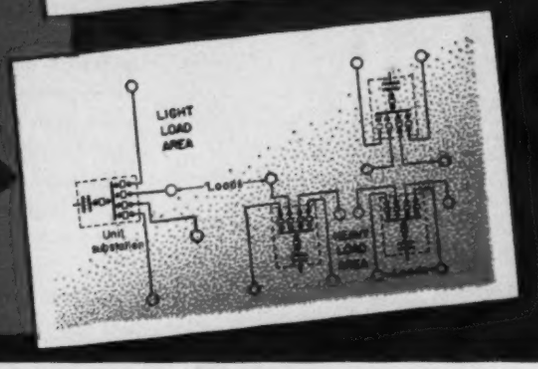
*All patent and manufacturing rights to th device or devices described in this article a reserved by the author.



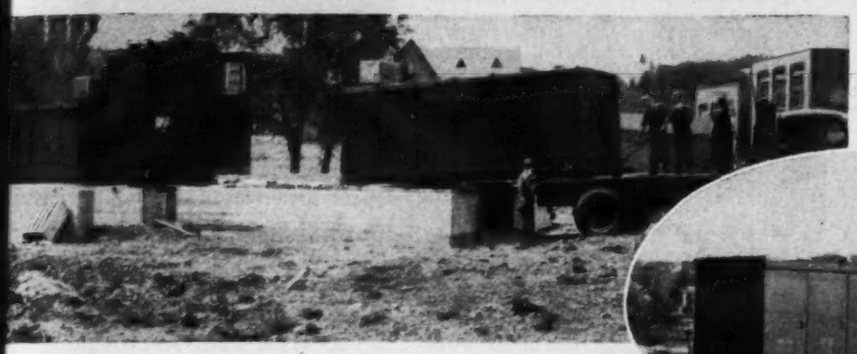
MOVABLE belt conveyor carriage distributes coal at any part of elongated storage pi

TO SUPPLY
QUICKLY NEW LOADS →
---THAT ARE LIKELY
TO SHIFT →

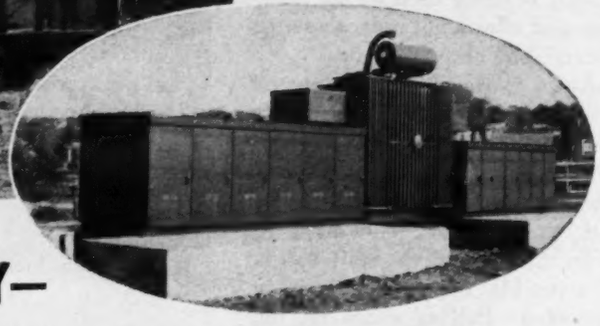




Install UNIT SUBSTATIONS



Even large unit substations like this (3000 kva) are shipped in completely assembled sections. Skid them into position, bolt them together, make the necessary connections—and the unit substation is ready for service.



OU CAN INSTALL THEM QUICKLY—
AND MOVE THEM EASILY IF THE LOAD SHIFTS

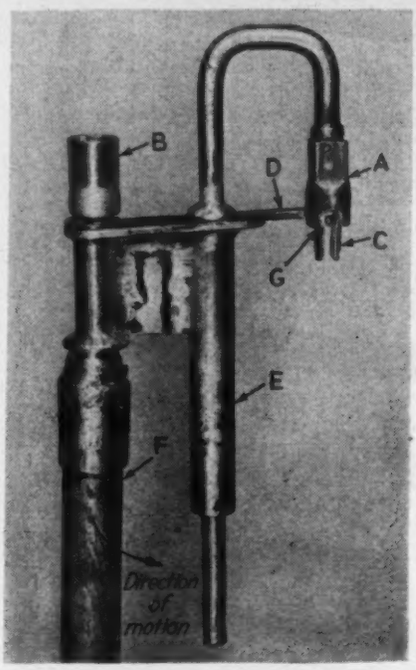
YOU can order and install G-E unit substations in a fraction of the time required or old-style, "piecemeal" substations. They re delivered in compact, completely assembled sections. By locating them right at oad centers, you shorten secondary runs, save ital copper, and reduce losses.

What's more, if the load shifts, the easy-to-andle sections make it easy to move a unit ubstation to the new load center, whether it e yards or miles away.

Installed, a unit substation is a single, coordinated, safety-enclosed unit that functions more dependably and gives extra protection to personnel. Designed for outdoor service—and with a pleasing appearance—they make large investments in real estate and buildings unnecessary.

From every angle, *unit* substations are the practical, far-sighted answer to the changing power requirements of today and tomorrow. A new, attractive 36-page bulletin contains complete, useful information. You can get a copy from your local G-E office, or by writing General Electric Co., Schenectady, N. Y.

GENERAL ELECTRIC



SPECIAL hot line tool designed to install and remove split bolt connectors from high-voltage conductors

and successfully used on the system of Kansas Gas & Electric Company, Wichita. It eliminates much of the necessity for the ordinary hot-tap clamp that is being used at the present time and effects not only a saving in material but also in labor.

As shown in the accompanying illustration, the tool is ready to install a connector. The split bolt "C" has been inserted in the socket "A" and is held in by the hook tip "G" of the element "D," inserted from back to front. In this attitude the split bolt is placed a-straddle of the conductors to be connected. Pulling down on the tool handle "F" against the tension of a coil spring incased in the tubular element "E," the operator revolves the tool handle counter-clockwise about the vertical axis of the tubular element "E." This brings the socket "B" and the connector nut into position to engage the threaded portion of the split bolt. As the handle of the tool was revolved as described the hook tip "G" of the element "D" also revolves counter-clockwise around the element "E," disengaging it from the split bolt. The split bolt is held a-straddle the conductor and firmly seated in the socket "A" by the action of the spring in "E" until the nut in socket "B" is fully threaded on the split bolt.

Operation of the hot-line tool for removing a connector is the reverse of that described above.

First working model of the tool shown was made by Roy Ridgeway, also of the Kansas Gas & Electric Company.

•

Experience With Portable Substations*

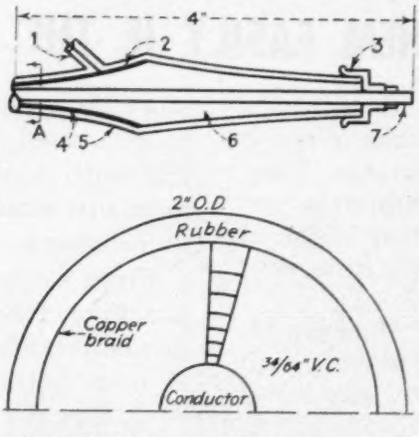
By R. McC. BYERS
Assistant to Electrical Engineer
Consolidated Gas, Electric Light & Power Company of Baltimore

When the 1,000-kva., 33-13/4-kv., three-phase portable substation was used for the first few times aerial high-tension connections were made with bare wires because no portable 33-kv. cables were manufactured at that time. For that purpose a unique design was developed for a single-conductor, 34-kv., extra-flexible, copper-sheathed, selenium rubber-jacketed, portable cable. Conductor size was set at No. 1 AWG to avoid corona. After calculations and graphical dielectric field mapping, a molded rubber terminal (see illustration) was designed and a 34/64-in. thickness decided upon for the varnished cambric insulation.

Four 150-ft. cable lengths were purchased. The fourth length is a spare and, although no portable cable failure has occurred in five years of service, it permits the cables to undergo regular inspections, tests and minor maintenance work, one at a time, without keeping the portable substation out of service. These original cables are still in hard field service together with many other new ones, all of which are still believed to be the only such high-voltage portable cables in existence.

The cables are hoisted up the poles and connected to the live high-tension lines by means of sticks and hot-wire connectors. Rubber jackets over the copper ground sheaths prevent any fault when the cables accidentally contact the low-tension lines on the same pole.

*Third in a series of four articles which began in the July 10, 1943, issue of "Electrical World."



PORTABLE cable terminal: outline (top) and cross-section (bottom).

1. Ground wire. 2. Stress cone. 3. Brass ferrule solder seal to wires cement seal to rubber. 4. Copper sheath. 5. Rubber jackets. 6. Varnished cambric insulation. 7. Conducter extending 8 in. beyond ferrule for attachment of hot line connector.

•

Tar Paper Sheath Protects Long Poles

TRANSMISSION POLES 60 to 90 ft. in length protected in storage by cover of tar paper to prevent weather damage

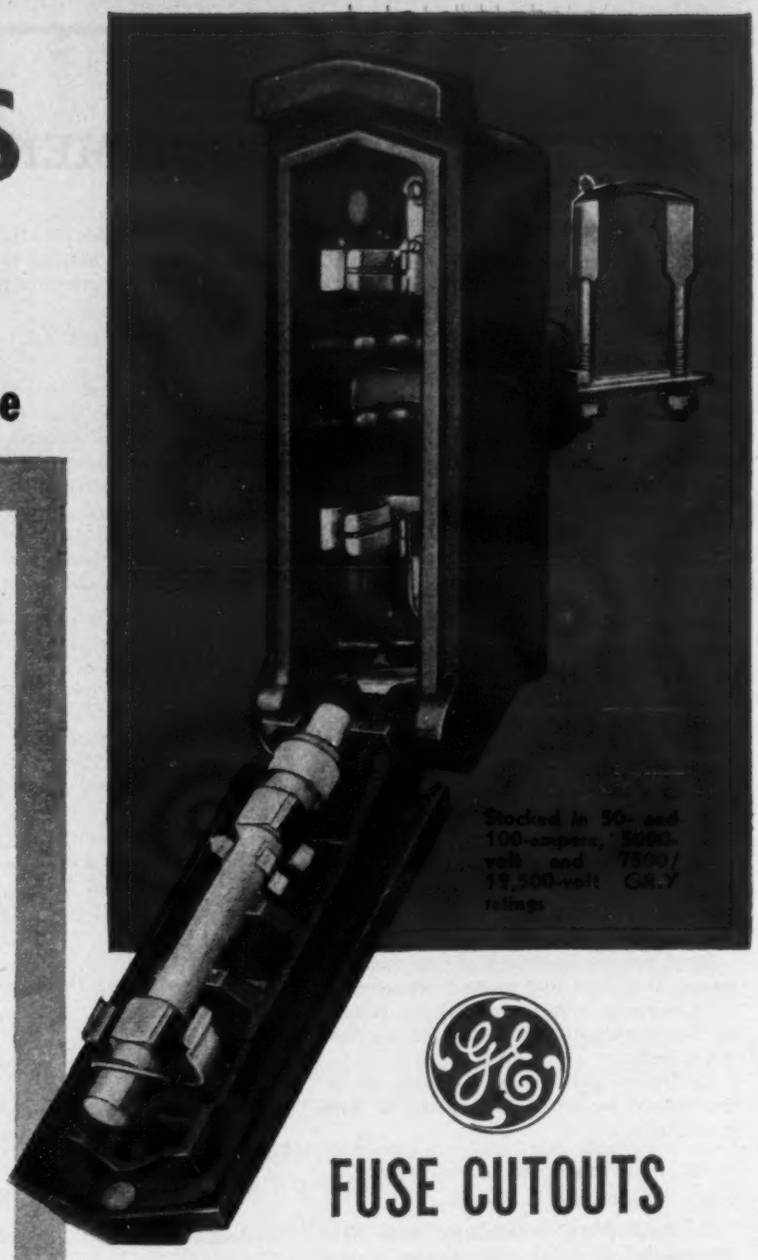
Transmission poles over 65 ft. in length held in stock for emergency replacement purposes by the Union Electric Company of Missouri transmission department are stored on racks as shown with the top half of their circumference covered with roofing paper. This protection is provided to prevent the wood from drying out in the sun, cracking and being subjected to decay or other damage due to rainwater collecting in cracks, freezing and splitting the poles, with the normal change of seasons.

The value of such poles, ranging in length from 65 to 90 ft., which may stay in storage for a period of two or more years, is believed to justify the $3.50 to $4 per pole required to protect them in this manner. Such cost is considered slight compared to the loss that would be sustained if the poles were found unusable in a system emergency.

Poles are covered with 90 lb. commercial roofing paper fastened at the sides with lathe and coated with tar once or twice the first year.

6 REASONS for Using G-E Nonindicating Cutouts to Protect Power Service

1. They are the lowest in price of all wet-process, porcelain-enclosed cutouts. You can make appreciable savings by using them where indication is not necessary.
2. Parts are standardized. All contacts, fuseholders, and other parts have been interchangeable since these cutouts were introduced, in 1928. This reduces stock requirements and maintenance costs.
3. The fuseholder, the barriers on the doors and in the cutout, and the housing are all of sturdy construction. Exhaustive tests and 15 years of operating experience prove that these parts successfully fulfill the requirements of interrupting duty.
4. Heavy-duty, silver-plated contacts of the high-pressure-blade type provide long life and low operating temperature even under heavy loading and unfavorable atmospheric conditions.
5. These cutouts function without movable parts, and regardless of atmospheric conditions.
6. The hanger clamps to the crossarm and provides a choice of vertical or angle, straight or swivel mountings. It is also interchangeable with the hanger of G-E indicating cutouts.



FUSE CUTOUTS

Since 1928 a million and a quarter have been put into service, and their operating record is excellent.

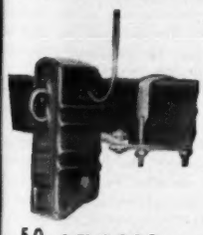
Savings Possible

You can make appreciable savings by installing nonindicating cutouts for all transformer installations not having secondary banking. The location of an outage is revealed by the telephone calls of power consumers. With banked secondaries, use G-E indicating or dropout fuse cutouts.

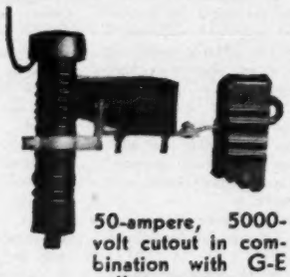
For complete information on G-E nonindicating cutouts, ask for Bulletin GEA-2390. For information on other G-E cutouts—enclosed-indicating, oil-filled, open-type, secondary-type—ask for Catalog GEA-2489. *General Electric Company, Schenectady, N. Y.*

406-15-5224

HIGH STANDARDS of reliability, simplicity, and safety have been established by the G-E wet-process-porcelain, nonindicating, enclosed fuse cutout.



50-ampere, 5000-volt cutout



50-ampere, 5000-volt cutout in combination with G-E pellet arrester

GENERAL ELECTRIC

BUY WAR BONDS

HOW TO GROUND
DISTRIBUTION EQUIPMENT*

I—GROUND RESISTANCE

Driven grounds having resistances higher than is deemed desirable should have their resistances lowered by one of the following methods, viz.:

A. Multiple grounds, which should not be less than 6 ft. apart except, when installed at the base of a pole set in concrete or other hard pavement, they may be driven at an angle of approximately 30 deg. to the pole.

B. Treated grounds. The method of treatment is to dig a conical-shaped hole 3 ft. in diameter and 2 ft. deep, centered on the ground rod when it is not too near the pole or adjacent to the rod when pole interferes. Put 75 lb. of rock salt in the hole and saturate with water. Back fill, tamping thoroughly. When using this method due consideration should be given to the possibilities of creating a hazard by settlement due to the dissolving of the salt.

II—GROUND TESTING

A. All new driven grounds should be tested at time of installation when the general knowledge of the territory indicates that the resistance of such grounds might be too high.

B. All driven grounds on secondaries having less than five ground connections to a common water pipe system should be tested periodically on a four- or five-year basis.

C. Driven grounds for lightning arresters should be tested on a four- or five-year basis.

III—EQUIPMENT TO BE GROUNDED

A. Distribution Secondaries:

1. Single-phase secondaries shall have the neutral of a three-wire system or one leg of a two-wire system grounded when the maximum voltage to ground from remaining wire or wires does not exceed 150 volts.

2. Three-phase, three-wire secondaries shall not be grounded except when the phase voltage does not exceed 150 volts.

3. Three-phase, four-wire secondaries supplied from Y-connected transformers and not exceeding 260 volts between phase wires shall have neutral ground.

4. On all secondaries on which grounding is required in Pars. 1, 2 and 3 above there shall be a ground connection at each customer's service entrance in accordance with the National Electrical Code 1940 Edition, Article 2523.

5. All secondaries on which grounding is required in Pars. 1, 2 and 3 above, having less than five grounds, on customer's premises connected to a common water pipe system shall have a driven ground rod connection at the pole. (See C, Par. 2 below.)

6. In rural locations the customer's ground connection shall be made to a driven ground rod not less than 8 ft. long, and in addition be bonded to any and all grounded metallic structures, such as a driven well.

B. Instrument Transformer Secondaries:

1. Instrument transformers located on customer's premises shall have their secondaries, cases and inclosures grounded by connecting the customer's ground.

2. Instrument transformers included in a pole-top primary meter installation shall be grounded in accordance with company's standardized practice.

C. Lightning Arresters:

1. Lightning arrester grounds shall be installed in accordance with company's established standards.

2. In no case shall lightning arrester grounds and secondary grounds be tied together or connected to ground rods at the same pole. Exceptions: Primary meter installation on pole top.

D. Equipment:

The non-current-carrying parts of any equipment, any part of which is less than 10 ft. above ground, shall be grounded. This includes: Transformer cases, meter inclosures, service switches, riser cable supporting steel, ornamental street light poles,† operating handles of manually operated air break switches. (The operating rods of such switches should have insulating sections located above the 10-ft. elevation.)

IV—DEFECTIVE GROUND CONNECTIONS ON CUSTOMER'S PREMISES

The company should refuse to make alive any new service or service to be reconnected if there is evidence of inadequate grounding of the customer's wiring.

Meter installers and testers should inspect ground connections on customer's premises and should report all defective ground connections to the meter superintendent. Exceptions: If the defect can be readily repaired the discovering employee may reconnect same.

† Ornamental street light poles supplied from a reasonably extensive underground system may be grounded by a connection to the lead sheath of the cable; in other instances the most effective available method shall be used.

V—METHOD OF GROUNDING

Apparatus	Pole Top	Platform 10 ft. or More Above Ground	Platform Less than 10 ft. Above Ground	Pole Base	Vault	Customer's Premises
Lightning arrester	Driven ground	.....	.....	.....	Vault ground	(Note A)
Instrument transformer						
Cores and cases	Do not ground	Do not ground	Driven ground	.....	Vault ground	Customer's ground (Note B)
Secondaries	Driven ground	Driven ground	Driven ground	.....	Vault ground	Customer's ground
Distribution transformer						
Cores and cases	Do not ground	Do not ground	Driven ground (Note D)	.....	Vault ground	(Note C)
Secondaries	All locations as per III A above					(Note A)
Riser cable sheaths, pothead bodies	Bond to lightning arrester ground	.....	.....	.....	Vault ground (Note E)	
Meter inclosure	.....	.....	.....	Driven ground	Vault ground	Customer's ground
Service switch non-current carrying parts	.....	.....	.....	(Note A)	Customer's ground	
Supporting steel	Do not ground	Do not ground	Driven ground	Driven ground	Vault ground	Customer's ground

Note A—Farm service with load center on pole. When there is only one pole (load center) on private property, the arresters shall be placed on take-off pole and grounded by means of driven ground. Secondaries shall be grounded by driven ground at foot of load center pole and customer's ground at each building entrance. Meter inclosure and non-current-carrying parts of service switch shall be bonded to grounded service conductor. When there is more than one pole on private property the transformer and arresters shall be located one span back from the load-center pole and arresters grounded by means of driven ground. Secondaries, meter inclosures and service switch will be grounded as described above.

Note B—The term "customer's ground" means connecting to secondary grounded neutral on supply side of customer's service switch.

Note C—Cores and cases of distribution transformers on customer's premises will be grounded only when transformers are less than 10 ft. above ground or in a vault.

Note D—When distribution transformers and lightning arresters are included in an industrial substation equipment the transformer cases, lightning arrester ground and steel structure will be connected to the substation ground. Transformer secondaries will not be grounded at the substation.

Note E—If riser cable terminates in a transformer vault the lead sheath shall be bonded to vault ground.

Note F—If the secondaries are lead sheathed from the distribution transformer(s) to customer's service entrance switch, these sheaths connect the vault (arrester) ground to the secondary (customer's) ground, and unless these two grounds are connected to a common water pipe system this interconnection must be avoided by the insertion of at least 2 ft. of non-leaded cable at any point between the exterior of the vault and customer's service switch.

* Adapted from Overhead Construction Standards of the New England Power System

War Time is Priceless!

ORDER ACCESSORIES WHEN YOU ORDER CABLES AND AVOID WIRING DELAYS

EVEN before the war, the common practice of waiting to order cable accessories until the cable for the job had been shipped frequently caused days of delay.

Today, however, it may even take a month or more before an accessories order can be approved and materials started on their way.

This holds up the wiring job unnecessarily. In the meantime, workers may be idle—and not just electricians alone, for other workers all along the line may be affected. Today, if never before, follow this wartime-saving practice:

1. Order accessories and cable at the same time —for delivery together.
2. When ordering unit package jointing material, include your order for terminals and potheads. If buried cables, remember joint boxes.

Every Anaconda unit package contains instructions and all materials required for the particular job. When ordering, please specify number of unit packages needed, operating voltage, size, number and shape of conductors, thickness and kind of insulation, thickness of lead sheath of cable.

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How to Close, Trip Circuit Breakers

1. Control*

By G. J. EASLEY
Switchgear Engineer, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Various methods of closing and tripping circuit breakers will be outlined in this series of articles, to give a general picture of this particular phase of design. Undoubtedly there are other methods worthy of note; similarly there are probably many variations of the schemes.

Large circuit breakers require a considerable amount of closing energy, the source of closing and tripping power may differ, and high speed tripping and reclosing are often involved. The smaller switchboard type of breaker is almost always closed and tripped directly by solenoids requiring little power; special requirements of high-speed tripping and reclosing are seldom involved.

Usual method of remote control used for circuit breakers is the electrically trip-free scheme shown in Fig. 1. Starting with the breaker in the open position, the sequence of operation is as follows: When the control switch on the switchboard is turned to the close position (*CS-C*) the *X* contactor coil is energized, causing it to pick up its contacts on either side of the closing coil (*CC*). Sometimes the *X* contactor has an extra seal-in contact which parallels the control switch, so that only a momentary

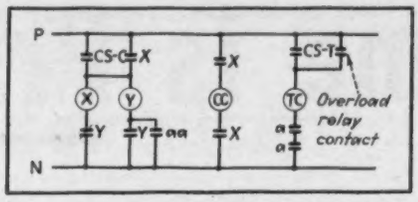

FIG. 1—Typical schematic control for circuit breakers. All contacts are shown in de-energized position—breaker open.

touch of the control switch is necessary. The seal-in contact must be used for reclosing service where the reclosing relay provides only a momentary completion of the closing circuit. As the breaker nears the closed position, the (*aa*) contact (rotary auxiliary switch, operated by lever attached to solenoid core on mechanically trip-free mechanisms) in series with the *Y* or cut-off contactor, closes. This energizes the *Y* contactor, causing it to simultaneously open a contact in series with the *X* contactor coil. At the same time it closes a contact which seals around the auxiliary switch (*aa*) contact. The opening of the first contact causes the *X* coil to drop out, thus de-energizing the closing coil. Closing of the second contact seals in the *Y* coil, keeping it energized even if the breaker should trip out. This action provides electrically trip-free operation, and since the breaker cannot close again until the *Y* coil is de-energized by opening the control switch the control scheme is also anti-pumping.

Sequence of the closing operation is shown by timing oscillogram (Fig. 2). It should be noted that the closing coil current starts to build up after the *X* contactor (52C) has operated; the current is cut off at the end of the closing stroke when the *Y* contactor (30 CS) operates.

To open the breaker the trip coil is energized either by turning the switchboard control switch to the "trip" position or through automatic action of overload relays. When the breaker is partially open the (*a*) contacts (rotary-auxiliary switch contacts—closed when breaker is closed) in series with the trip coil, open to de-energize the trip coil. The control scheme shown in Fig. 1 is for a direct-current, solenoid-operated mechanism, but is typical for any method of operation. Circuit breaker standards specify that satisfactory closing be obtained using 72 to 104 percent of normal control voltage. However, ample size control cable to the breaker should be used in order that load voltage will not be appreciably below normal.

* First in a series of twelve articles.

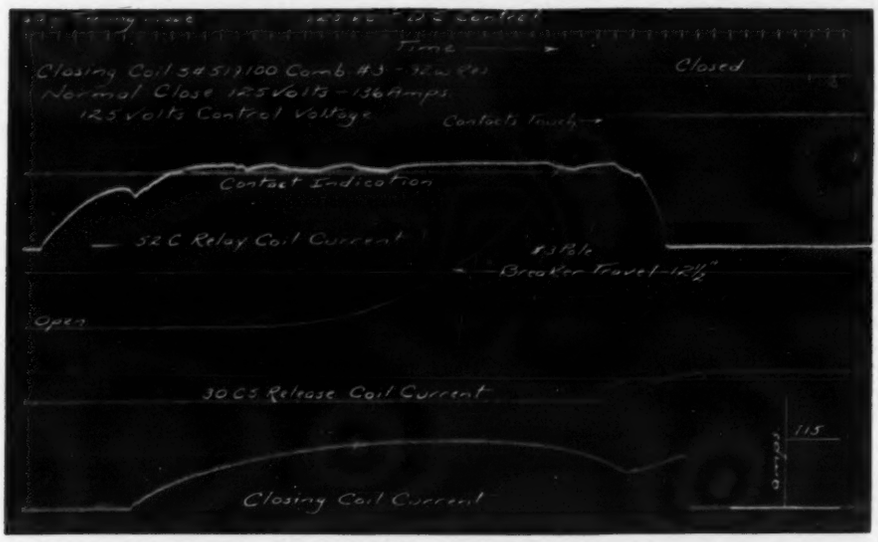

FIG. 2—Timing oscillogram showing sequence of closing operation for a 15-kv., 2,000-amp., 3-pole, 60-cycle, oil circuit breaker having 125-volt d.c. control.

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Improved Insulating Oil Reclamation

For reclamation of insulating petroleum oils Boston Edison salvages under specifications dividing the oil into three preliminary groups according to viscosity (50-70, 70-80 and 80-100). For quality control certain characteristics of new oils are used as objectives; *e.g.*, viscosity, pour point, flash, color and dielectric. These are approached as practical reclaiming methods allow. Reclaimed oil viscosity classes are again subdivided according to pour point, for such oils may be used indoors or outdoors. A further subdivision is made as a result of the high flash point preferred for oil switches, this point being the same as that of new oil used for this purpose. Oils which are left—*i.e.*, those not meeting the pour or flash tests, or those coming between 70 and 80 viscosity—are classed as "Edison Line Oil" and are generally used in distribution transformers. This classification gives the operating departments a chance to select a reclaimed oil for practically any purpose.

The company uses a Sharples super-centrifuge in series with a General Electric 7-in. blotter press. Oil is pumped through the centrifuge direct from the drum in which it has been returned from the station or other field location. It is heated to 120 F. by two 6-kw. immersion heaters with

L-M PVD

...the only fuse cutout of its kind, gives better protection because of these factors

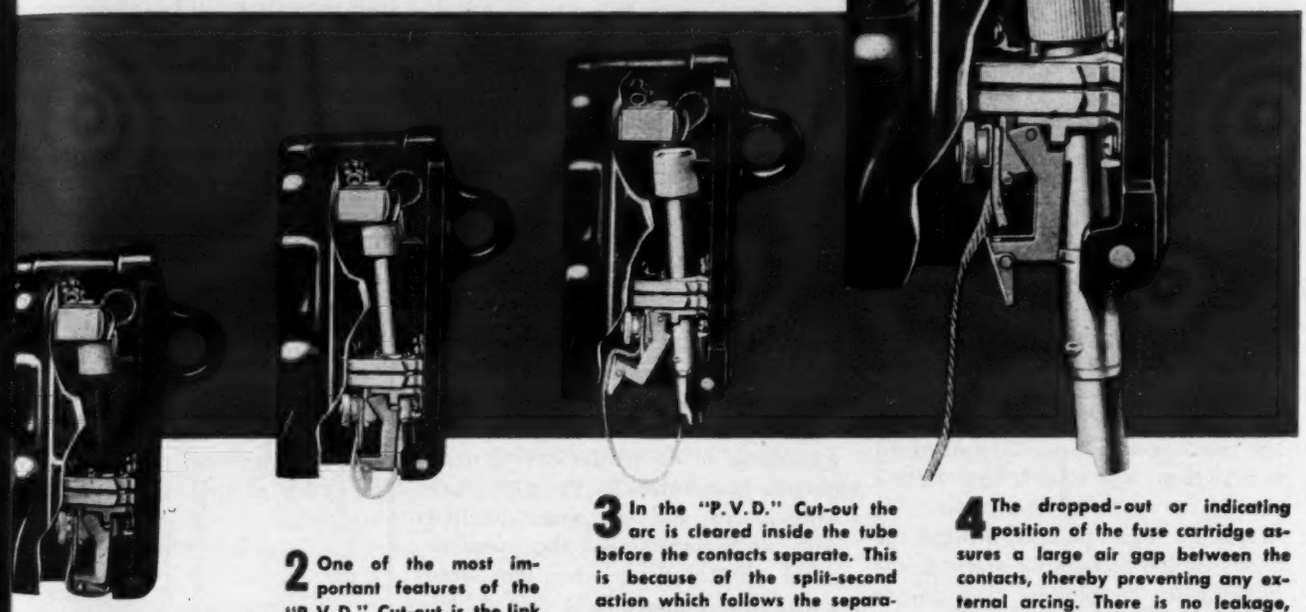
unfailing operation Because operation of PVD is independent of any door movement and because all working parts are fully protected, the PVD operates as a disconnecting or dropout cutout *at all times.* Cartridges will always be out of circuit when link has blown.

spots trouble Tell-tale position of the dropped cartridge is readily visible from any direction and distance—spots the trouble quickly and saves hunting.

safe, cool contacts Positive, heavy contacts, large contact surfaces, elimination of intermediate current carrying parts in circuit path, keep operating temperatures of PVD low.

arc quickly cleared When link blows, flip-out device pulls the link apart and out of the cartridge. Arc positively extinguished before any contacts move or separate. A large airgap between contacts prevents any re-establishing of the arc.

easily, quickly re-fused Outages quickly restored. The PVD can be re-fused in one minute—a safe, easy operation right on the pole, even with gloved hands.



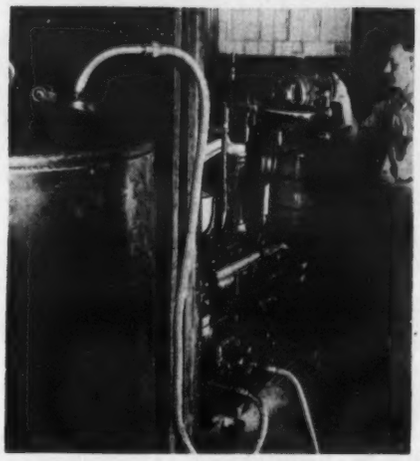
The "P.V.D." Cut-out is always protected. The rugged bakelite door remains closed even after the fuse link has blown. Its contacts assure safe, dependable operation because they are always sealed from weather, dirt, and corrosion.

2 One of the most important features of the "P.V.D." Cut-out is the link flip-out device which assures instant separation of the blown fuse link parts before the latching lever releases the tube to the indicating position. There is a positive time delay. The flip-out device snaps down, the blown link is separated instantly.

3 In the "P.V.D." Cut-out the arc is cleared inside the tube before the contacts separate. This is because of the split-second action which follows the separation of the blown link. The latching lever releases the tube, permitting it to drop to the indicating position. The upper contact follows this tube when dropping and, therefore, maintains contact during a good portion of the downward travel of the tube. This absolutely assures the arc being cleared before the contacts separate.

4 The dropped-out or indicating position of the fuse cartridge assures a large air gap between the contacts, thereby preventing any external arcing. There is no leakage, no radio interference. Because metal slides on metal when the cartridge drops, it operates smoothly without sticking, which assures dependable, positive operation under all weather conditions. In addition to this, the dropped-out position is a signal easily seen from the ground and prevents hunting for the cut-out with the blown fuse link.

LINE MATERIAL COMPANY LM



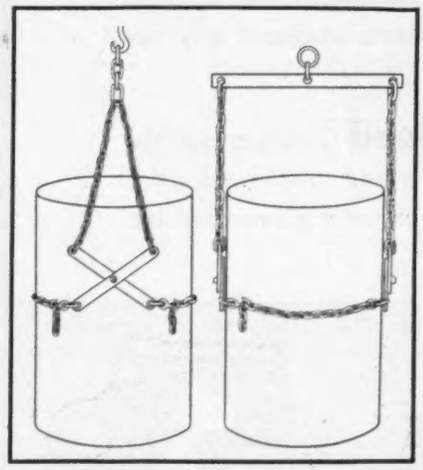
PORTION of reclaiming equipment at Boston Edison service plant

automatic thermostat control. From the centrifuge it passes directly into an open top 55-gal. drum. The centrifuge is used to heat the oil and for "rough cutting," *i.e.*, to remove coarse dirt and water. Formerly the company had not been able to restore the color by centrifuge alone because much of the oil had been reclaimed by previout incomplete methods, and apparently because it had been reused so many times that it contained much very fine carbon in suspension. After the "rough cutting" and heating of the oil, it is pumped from the open-top drum through the press. Experience shows that a small amount of activated filter clay is a great aid in improving the color and removing suspended matter. For this reason, after insertion of clean blotters, the press is always charged with two tablespoonfuls of the clay. This charging is done by pumping through the press the two tablespoonfuls of clay well stirred into 4 gal. of oil. To save time a small open drum of clay and oil is mixed each day. Inside this drum are marker lines 4 gal. apart. The drum is filled with 20 gal. of oil and 10 tbsp. well mixed. Each time a charge is required the mixture is stirred and 4 gal. pumped through the press. As the reclaiming proceeds the pressure on the blotters rises due to the dirt covering the first blotter of each set. When the pressure reaches 100 lb. the first blotters are changed and the press recharged.

Characteristics After Reclamation

The company has found that the pour point went up with severe use and by contaminating with high pour point oils. Reclamation did not correct it. There was little change in flash point between a new oil and the same oil after use and reclaiming. Color was restored, not necessarily to that of new oil, but at least to a clear, bright, satisfactory appearance in all cases. It was either reddish or yellowish. Dielectric was brought up over 22 kv. in practically all cases on a single reclaiming run. Acidity was seldom over 1 mg. KOH and was reduced by reclaiming. Extremely dirty, strong smelling oils have been found not worth reclaiming. They are set aside for settlement for fuel oil, road oil and other miscellaneous requirements. Viscosities of reclaimed oils grouped themselves and bore a close relation to new oil, usually a few seconds less.

The following improvements were made in operating conditions: (1) A chain sling was used to lift drums



CHAIN SLING designed to facilitate handling drums having end bungs

having end bungs. (2) 1½-in. IPT fire hose couplings were attached to the centrifuge suction hose to facilitate hand tight connections. (3) Drain pans were made for 4-oz. and 1-qt. sampling bottles. (4) A thermostat was placed in the blotter drying oven circuit. (5) Valves in the pipe lines were closed and the stems painted with white lacquer so the operator could tell at a glance when they were open. (6) A small, light desk 42 in. high to be carried to the job was made for use of the machine and test men. (7) The discharge rate of the centrifuge was controlled by the bypass valve, one turn open for dirty oil, ½ turn for medium and closed for relatively clean oil. A white mark on the valve wheel indicated these positions.

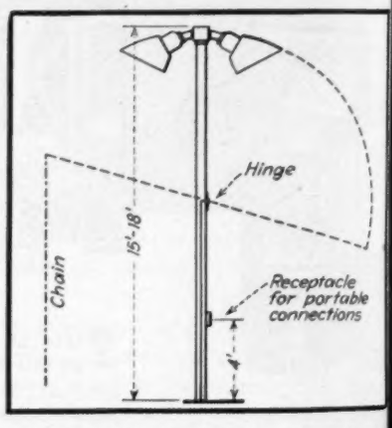
The capacity of the reclaiming installation is 220 gal. in 1.25 hours.

Post Lights for Industrial Areas

By E. R. BONDS
Robert & Company, Inc., Atlanta, Ga.

In certain industrial areas overhead suspension of lighting units just can't be right. Cranes, hoists, conveyors and structural features associated with production machines whose massive shapes rise high from the floor rule out the usual way of providing light from levels safely above the movement of work. And in such areas dust and other dirt are usually plentiful, making necessary more frequent cleaning of lighting units. Also a higher than usual component of horizontal light may be required to see into the production machines.

For situations of this kind successful lighting installation has been designed by Robert & Company employing hinged posts of the type commonly used in automobile service stations, as shown in the accompanying drawing. Posts are available —with proper priority authorization —in different heights and lamps may be mounted on them in various numbers and arrangements. In one installation made by Robert & Company 18-ft. posts were used, each supporting two 500-watt lamps in symmetrical angle reflectors mounted back to back. The reflectors are fitted with clear glass covers to make them dust-tight and the frequent cleaning that is necessary is mostly a matter of



HINGED POSTS solve lighting problem

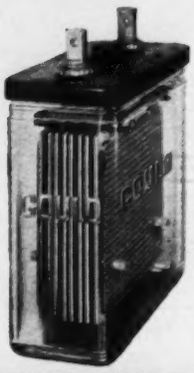
wiping off the glass. This can be done very quickly with the top half of the post swung down. An additional convenience afforded by the lighting posts was that they furnished exceptionally accessible places for receptacle outlets for connection of portable lamps and tools.

GOULD DESIGNS, BUILDS AND INSTALLS THE RIGHT BATTERY TO DO YOUR JOB

• This is an age of specialization. Mammoth machines are designed to make a single part. Factories are built to produce just one article. Specialization pays big dividends in added efficiency and lower operating costs.

To get the best results every industrial storage battery must be designed to perform a particular task. Specialization in designing and manufacturing storage batteries to do the job has made the name Gould a tradition.

No matter what the battery problem, Gould field engineers bring expert knowledge to on-the-spot investigations. Gould factories translate their findings into the proper installation. Here is a specialized service at your command. We invite you to use it.



The battery with antimony free positives for control and standby applications.

Rated Conservatively . . . *Goulds equal or exceed in capacity any battery of comparable size and cell structure.*

GOULD STORAGE BATTERY CORPORATION, DEPEW, NEW YORK

Builders of industrial batteries for every application. Sales and service offices in principal cities of the U. S. A

Factories at Depew, N. Y., North Bergen, N. J., Dallas, Atlanta, Chicago, St. Paul, Leavenworth, Los Angeles

FOR EXCELLENCE IN STORAGE BATTERY PRODUCTION AT DEPEW PLANT

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Since 1898 THE BATTERY PICKED BY ENGINEERS

ACCURATE BATTERY CHARGING IMPORTANT

One of a series of service suggestions for users of industrial batteries.

▶ Be sure to charge your battery accurately. Consistently overcharging or undercharging of a storage battery (it doesn't matter what type or who makes it) will shorten the period of useful service which that battery will give.

An occasional overcharge can be beneficial but, if done too often, it produces corrosion of the positive grids and creates an excessive gassing that will loosen some of the active material in the plates. It also raises the internal temperature of the battery. This accelerates corrosion and, if continued, the heat will char the separators in those types of batteries where these units are made of wood.

Undercharging results in a gradual running down of the cells, and is a contributory cause to buckling. When undercharging is continued over a period of time one of the cells usually becomes exhausted ahead of the others and may become reversed. This greatly reduces the power of the battery, but it can be remedied by charging the battery until all cells are again equalized.

Overcharging, particularly when it follows a previous condition of undercharging, tends to increase the bad effects of both operations. The heat and unusual strains cause the plates to buckle and the separators, when of wood construction, may become perforated.

There is nothing difficult about charging storage batteries accurately. It is largely a matter of setting up and following a fixed pattern of operation, and then making one man responsible for seeing that it is carried out. Continuous operational charts will assure this being done and Gould employs a staff of service men who will install a service record system to fit your particular requirements. There is no obligation on your part.

We would like you to know the Gould men who will take care of your industrial storage battery requirements.

Serving the Eastern Metropolitan area are Mr. E. R. Jacobsen, Sales and Service Manager, W. W. Halsey, George P. Bownan, and D. F. Bruce, with headquarters at 369 Lexington Ave., New York City. Also in this same territory is Phil Ascher, located at 80 Federal St., Boston, Mass.

The Gould factory at North Bergen, N. J., is centrally located in this area and the home factory at Depew, N. Y., borders it on the West.

(Advertisement)

AMPERE CAPACITY
FOR COPPER BARS, RODS AND TUBING

By R. C. FINK, Engineer Bureau of Power and Light, City of Los Angeles

Data on Copper Bars

Size, In.	Area, Cir.mil	Lb. per ft.	Ampere Capacity at ... Cir.mil per Amp.			Size, In.	Area, Cir. mil.	Lb. per ft.	Ampere Capacity at .... Cir.mil. per Amp.		
			1,000	1,200	1,600				1,000	1,200	1,600
1/8x1	159,154	0.482	160	133	100	3/8x1	477,463	1.45	478	400	300
1/8x1 1/2	238,731	0.723	238	200	180	3/8x1 1/2	716,194	2.17	716	597	448
1/8x2	318,309	0.964	318	265	200	3/8x2	954,927	2.89	955	796	597
1/8x2 1/2	397,886	1.21	398	330	250	3/8x2 1/2	1,193,658	3.62	1,195	995	746
1/8x3	477,463	1.45	477	400	300	3/8x3	1,432,390	4.34	1,432	1,195	895
1/8x3 1/2	557,040	1.69	577	464	350	3/8x3 1/2	1,671,122	5.06	1,671	1,390	1,045
1/8x4	636,618	1.93	637	531	395	3/8x4	1,909,854	5.79	1,910	1,590	1,194
1/8x5	795,772	2.41	796	663	497	3/8x5	2,387,317	7.24	2,387	1,990	1,490
1/8x6	954,927	2.89	955	800	597	3/8x6	2,864,781	8.68	2,865	2,387	1,790
1/4x1	318,309	0.964	318	265	200	1/2x1	636,618	1.93	638	530	400
1/4x1 1/2	477,463	1.45	477	400	298	1/2x1 1/2	954,927	2.81	955	796	598
1/4x2	636,618	1.93	637	530	398	1/2x2	1,273,236	3.86	1,273	1,060	796
1/4x2 1/2	795,772	2.41	796	660	495	1/2x2 1/2	1,591,545	4.82	1,592	1,326	995
1/4x3	954,927	2.89	955	800	597	1/2x3	1,909,854	5.79	1,910	1,592	1,194
1/4x3 1/2	1,114,081	3.38	1,114	928	696	1/2x3 1/2	2,228,163	6.75	2,228	1,860	1,393
1/4x4	1,273,236	3.86	1,273	1,060	796	1/2x4	2,546,472	7.72	2,546	2,120	1,592
1/4x5	1,591,545	4.82	1,592	1,325	985	1/2x5	3,183,090	9.65	3,183	2,653	1,989
1/4x6	1,909,854	5.79	1,910	1,590	1,190	1/2x6	3,819,708	11.58	3,820	3,183	2,380

Data on Standard Iron Pipe Size Copper Tubing

Size of Pipe, In.	Approx. O. S. Diam., In.	Approx. I. S. Diam., In.	Actual Cir.mil Area	Lb. per Ft.	Ampere Capacity at .... Cir.mil per Amp.		
					1,000	1,200	1,600
1/8	13/32	17/64	85,064	0.26	85	71	53
1/4	9/16	23/64	150,975	0.45	151	126	94
3/8	11/16	1/2	221,369	0.65	221	184	138
1/2	13/16	5/8	314,975	0.95	315	262	196
3/4	1 1/16	53/64	426,816	1.31	427	356	267
1	1 5/16	1 3/64	601,381	1.79	601	501	376
1 1/4	1 5/8	1 3/8	884,176	2.63	884	737	553
1 1/2	1 7/8	1 39/64	1,050,000	3.15	1,050	875	656
2	2 3/8	2 1/16	1,388,781	4.20	1,389	1,157	868
2 1/2	2 7/8	2 15/32	2,015,625	6.04	2,016	1,680	1,260
3	3 1/2	3 1/16	2,874,156	8.72	2,874	2,395	1,796
1 1/2	4	3 1/2	3,750,000	11.45	3,750	3,125	2,344
4	4 1/2	4 1/32	4,250,000	13.33	4,250	3,542	2,656

Data on Copper Rods

Diam., In.	Area, Cir.mil	Lb. per Ft.	Ampere Capacity at .... Cir.mil per Amp.		
			1,000	1,200	1,600
1/4	62,500	0.189	63	52	39
5/16	97,700	0.285	98	82	61
3/8	140,600	0.426	141	117	88
1/2	250,000	0.757	250	208	156
5/8	390,600	1.18	391	326	244
3/4	562,500	1.70	563	470	350
7/8	765,600	2.32	766	640	480
1	1,000,000	3.03	1,000	835	630
1 1/8	1,265,600	3.83	1,266	1,050	790
1 1/4	1,560,000	4.72	1,560	1,300	975
1 3/8	1,890,600	5.72	1,891	1,580	1,180
1 1/2	2,250,000	6.81	2,250	1,875	1,410
1 5/8	2,640,600	7.99	2,641	2,200	1,650
1 3/4	3,062,500	9.27	3,063	2,550	1,810
1 7/8	3,515,600	10.64	3,516	2,820	2,200
2	4,000,000	12.11	4,000	3,330	2,500

Current-carrying capacity of a conductor is determined by the temperature rise of the conductor resulting from the losses of conduction. For copper conductors the accepted standard of the A.I.E.E. and N.E.M.A. limits this temperature rise to 30 C. above a maximum ambient of 40 C. If this limit is maintained it is obvious that the actual current carried will vary with the ability to dissipate heat losses.

Conditions under which heat is dissipated may range from (1) inclosed installations where there is little air and therefore being difficult to dissipate heat, and (2) open indoor installations where rising air currents are set up by convection, thus assisting heat dissipation; to (3) outdoor installations where, although partially offset by exposure to the sun, the air currents due both to wind and convection greatly aid heat dissipation.

Accompanying tables are adapted from the bureau's Electrical Standards. The tabulated data not only present ampere capacity but also weight in pounds per foot for various sizes and shapes of copper conductors ordinarily used in generating stations and substations. The ampere capacity of 1,000 cir.mil per amp. is intended for outdoor installation; that of 1,200 cir.mil per amp. for indoor or open installations, and 1,600 cir.mil per amp. for inclosed installations.

Why Stu doesn't need to know "overload" exists

is top-turret gunner on a 4-engine mber.

He knows a whale of a lot about op- ting his turret and his gun. But he esn't know anything about "overload" . doesn't care to know . . . doesn't ve to know.

Here is why.

Some time ago, electrical-design en- eers recognized that the motors op- ting any gun turret would have to et extreme conditions of overload. e turrets stop and start quickly in ttle. Sometimes they must work inst the air stream. They must be all in comparison to the horsepower ey deliver.

Taking care of this overload naturally olved an insulation which could stand igh temperature rise. To get such an ulation, the electrical industry sought Fiberglas* Electrical Insulations and ubined them properly with the newest pregnants.

In addition to withstanding overload, these Fiberglas combinations are very light in weight, have a low space factor, and excellent moisture resistance.

Today, almost all American aircraft contain motors no larger than your fist up to babies big enough to start the engines. Most of them are Fiberglas-insulated.

The aviation industry's demands for Fiberglas have been constantly growing because of an *increasing* use of Fiberglas in an air force which is *expanding*.

Besides, both Army and Navy are using more and more Fiberglas in many other types of equipment as well as for wire and cable insulation.

Although Fiberglas production was greatly expanded last year and is now being increased every month, vital war demands have so far kept pace with this expansion.

These are the reasons why your electrical distributor may not have been able to fill your orders promptly. *Owens-Corning Fiberglas Corporation, Toledo, Ohio. In Canada, Fiberglas Canada, Ltd., Oshawa, Ontario.*

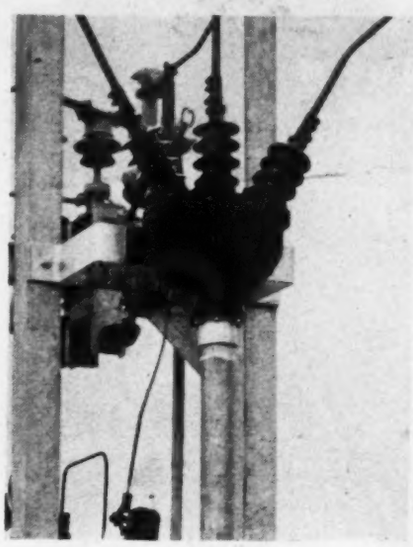
Fiberglas Electrical Insulations

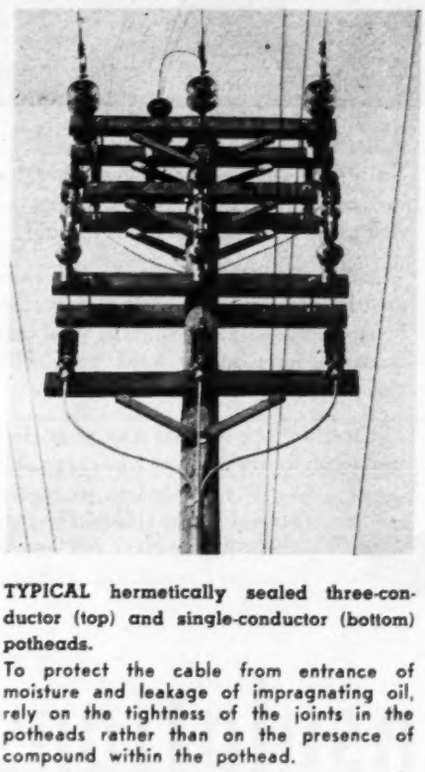
*Reg. U. S. Pat. Off.

Fundamentals of Potheads

By C. W. SWARD
G & W Electric Specialty Company
Chicago, Ill.

A hermetically sealed cable-end device known as a pothead (a cable terminal or an end-bell) is used for terminating an electric insulated cable and for making connections to the wires within the cable. An important function is to prevent the entrance of moisture and leakage of cable-impregnating oil, either of which would eventually result in failure of the cable by affecting the insulation.





TYPICAL hermetically sealed three-conductor (top) and single-conductor (bottom) potheads.

To protect the cable from entrance of moisture and leakage of impragnating oil, rely on the tightness of the joints in the potheads rather than on the presence of compound within the pothead.

The pothead consists usually of three major parts:

1. A metal bell which is fitted to the cable sheath to provide a moisture- and oil-tight inclosure and a support for the cable end.

2. Connectors for joining the conductors within the cable to those outside.

3. Insulators, usually porcelain, for insulating the connectors and the bared conductor ends from each other and from ground.

The insulators must be of proper length to provide sufficient internal as well as external creepage distance for the operating voltage. The wall thickness of the insulators is determined by consideration of mechanical strength as well as the voltage. Outside connections must be properly spaced to prevent flashover between the connections. The insulators must be sealed where they fasten into the metal bell and at the top where the outside connections are made.

After being assembled on the cable end, the pothead is filled with compound which serves as a space filler of high dielectric strength. The compound should extend well up in the porcelain bushings in order to eliminate voids on the conductor insulation. Compound increases the creepage resistance along the conductor insulation and on the porcelain surface, also enhances the insulation characteristics within the pothead between the cable conductors and between the conductor and ground.

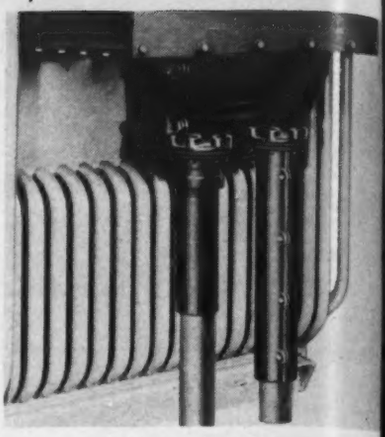
Equipment Potheads

Equipment potheads are the same as regular (cable) potheads except that they are provided with flanges for bolting onto the equipment.

Cables terminating in air- or oil-filled equipment such as transformers, switchgear and connection boxes should also have their ends protected by potheads (or unit hermetically sealed cable-end compartments).

If the equipment is air-filled the pothead is necessary to prevent cable trouble due to loss of impregnating oil and due to effect of moisture-laden air on the cable insulation. If the equipment is oil-filled the pothead provides a stop joint, which is necessary to prevent migration of oil from the equipment into the cable, and vice versa, either of which is likely to cause trouble.

On account of the hazards to workmen and to the cable itself, it is undesirable to leave the cable beyond an equipment pothead exposed to accidental damage. With large equipment, which cannot be raised or moved easily, the conduit must be terminated far enough from the equipment to permit lowering the pothead and bending the cable for assembling the pothead on the cable.

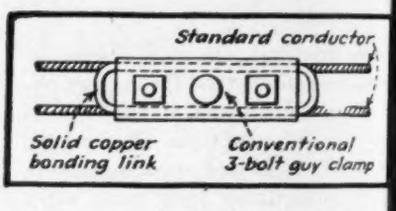


TWO METHODS of inclosing cable between the end of the conduit and the pothead.

The one at the left uses an oversize telescoping pipe and the other a split-clamped conduit extension. The latter is usually preferred because it permits fuller use of the available space between the equipment entrance and the floor or foundation for handling the cable during installation and for assembling the pothead.

•

Guy Clamp Becomes Emergency Connector



The common three-bolt guy clamp, available in most utility storerooms in some quantity, can be made to "do" as a substitute for clamps using more critical material in connecting solid and stranded line conductors in the larger size.

The trick, which was conceived by the Empire District Electric Company engineers, Joplin, Mo., is to loop a short piece of solid copper wire through both parallel grooves of the clamp and thus provide a copper-to-copper path for the current from one line conductor to the other

Winning the *"Battle of Production"* involves a lot more than a supremacy of materials, machinery and manpower. One major fire in a central station . . . or a small fire that results in crippling damage to turbines, generators, switches or transformers by the extinguishing medium . . . can halt or slow down war production in a dozen vital plants.

Cardox Fire Extinguishing Systems are guarding against these crippling fires in central stations vital to the production of a wide variety of critical war products. Furthermore, individually engineered applications are on duty—in addition to protecting the power output of central stations—in important plants producing such military necessities as:

Airplanes, Aviation Engines, Aviation Carburetors, Airplane Parts, Engine Parts, Plastics, Rubber Products, Processed Fabric, Tanks, Tank Engines, Cold Strip Steel, Armor Plate, Forgings, Solvents.

By instant smothering of fire and cooling of combustibles through the mass discharge . . . at high rate of flow . . . of low pressure, low temperature CO_2, Cardox Systems provide the all-important advantage of fast, complete extinguishment of large or small fires—without damage by the extinguishing medium.

Today, Cardox is concentrating its engineering and manufacturing facilities on two basic activities: (1) Designing and manufacturing of Cardox Fire Extinguishing Systems needed to make it possible for the Armed Forces of America to have more planes, guns, tanks and ammunition; (2) working with industry on plans to increase the efficiency of fire protection both today and after the war.

If you would like more information, write on company letterhead for Bulletin 583.

CARDOX CORPORATION
BELL BUILDING • CHICAGO 1, ILLINOIS
***District offices in* New York • Washington Detroit • Cleveland • Atlanta • Pittsburgh San Francisco • Los Angeles • Seattle**

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How Cardox Systems Protect War Industries

- **Timed discharges, as needed, through built-in piping systems . . . supplied instantly from a single storage unit holding tons (if required) of liquid Cardox CO_2.**
- **Mass discharge of Cardox CO_2 "knocks out" fire, by . . .**
- **Reducing oxygen content of the atmosphere below the concentration necessary for combustion, and . . .**
- **Cooling combustibles and fire zone below ignition temperature . . .**
- **Extinguishing fire quickly and completely *without* damage from extinguishing medium.**

CARDOX—CO_2 Systems with Enhanced Fire Extinguishing Performance

A. Uniformity of CO_2 characteristics.
B. Extinguishing medium with uniformly greater cooling effect.
C. Accurate projection of CO_2 through greater distances.
D. Timed discharges, as needed, through built-in piping systems . . . supplied quickly from a single tank holding tons of liquid Cardox CO_2.

MASS DISCHARGE OF CO_2 · ENHANCED COOLING EFFECT · CENTRAL STORAGE UNIT · AMPLE CO_2 RESERVE · ENGINEERED SYSTEMS · MANUAL OR AUTOMATIC CONTROL

CARDOX

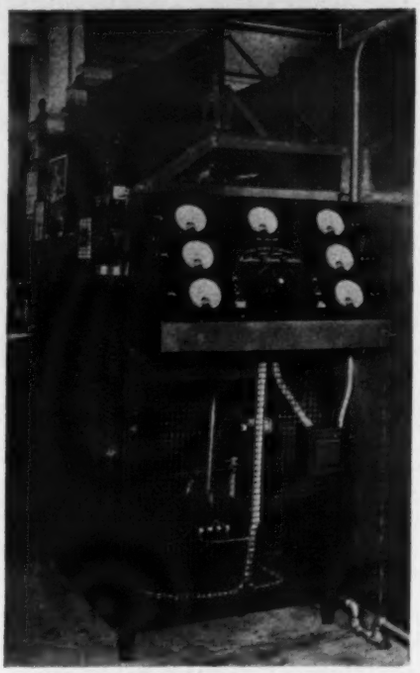
NON-DAMAGING FIRE EXTINGUISHING SYSTEMS

without passing through the iron of the clamp. The sketch shows how this can be done.

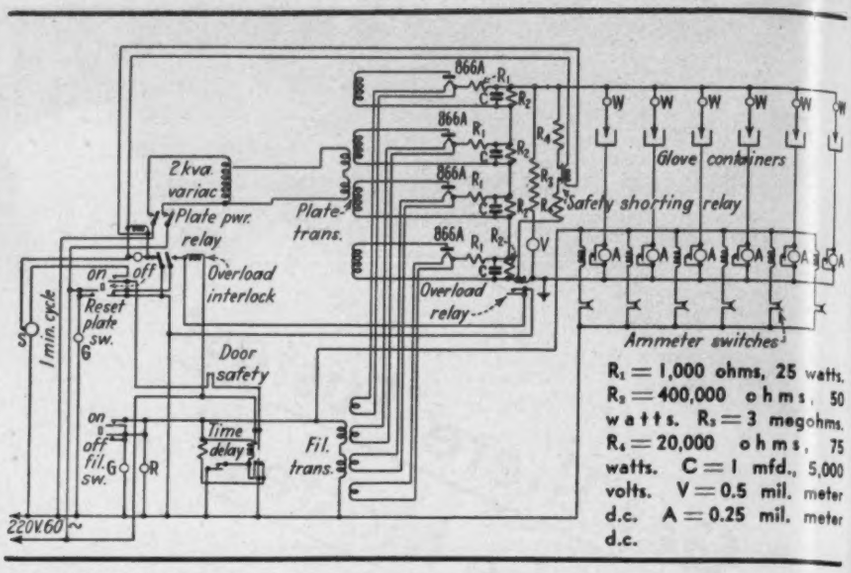
•

Rubber Gloves Tested With D.C. Equipment

A unit equipment operated from an a.c. circuit and supplying d.c. power for testing rubber gloves has been designed by Leonard G. Walker, engineer, Idaho Power Company, Boise,



ASSEMBLY of d.c. rubber glove testing equipment, completely inclosed in heavy wire mesh; rectifying equipment is located in the bottom of the cabinet; glove testing compartment is at top



SCHEMATIC DIAGRAM of complete connections of d.c. glove testing equipment

and was assembled in the company's shops. The tester, connected as shown in the diagram, uses four conventional medium-voltage power sources in series to supply 15,000 volts d.c. The special transformers for the rectifier were supplied by Thordarson. A General Radio Company "Variac" is used to vary the 240-volt input to the plate supply transformer of the 15,000-volt power supply.

During test the gloves, after washing and sterilizing, are placed in containers, metallic cans, filled with water. The gloves themselves are then filled with water to a level with the tops of the containers, the latter being connected to ground. Chains hung so as to dip into the water in the gloves are connected with the opposite side of the circuit. The actual test is conducted at a potential of 14,160 volts d.c., equivalent to the peak of a 10,000-volt a.c. sine wave.

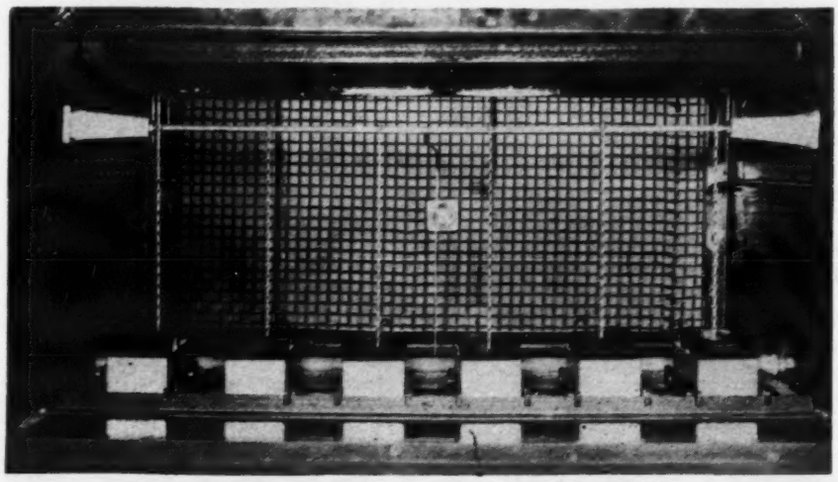
A voltmeter indicates voltage for all containers, while a milliameter is connected in the circuit of each glove, there being six under test at a time.

An advantage of direct current in this test lies in the fact that there is no constant flow of charging current (the glove and water on two sides acting as a condenser) as would be the case using alternating current. Therefore, an indication by an ammeter shows a leak, whereas with alternating current it could indicate charging current also.

The auxiliary control equipment provides for time test cycle, electrical leakage measurements and safety precautions to protect operator and equipment.

In operation, if any glove fails, the circuit is automatically tripped out so as not to injure equipment. Then the voltage is lowered to a very low value and the circuit closed again. This low voltage causes flow of current through the milliameter, though not enough to injure it. The milliameter then registers, showing which glove is defective.

In the illustration of the complete equipment the containers are near the top of the cabinet, over which is a wire mesh cover. It is only after the cover is let down and locked in place that the potential can be applied, by means of a special switching mechanism operated by the lock. This makes it impossible for the operator to come in contact with live parts, all the rest of the cabinet being also inclosed with heavy wire mesh.



GLOVES under test are inserted in grounded, water-filled cans and the gloves themselves filled with water; the chains dipping into the gloves connect with the high potential side of the circuit

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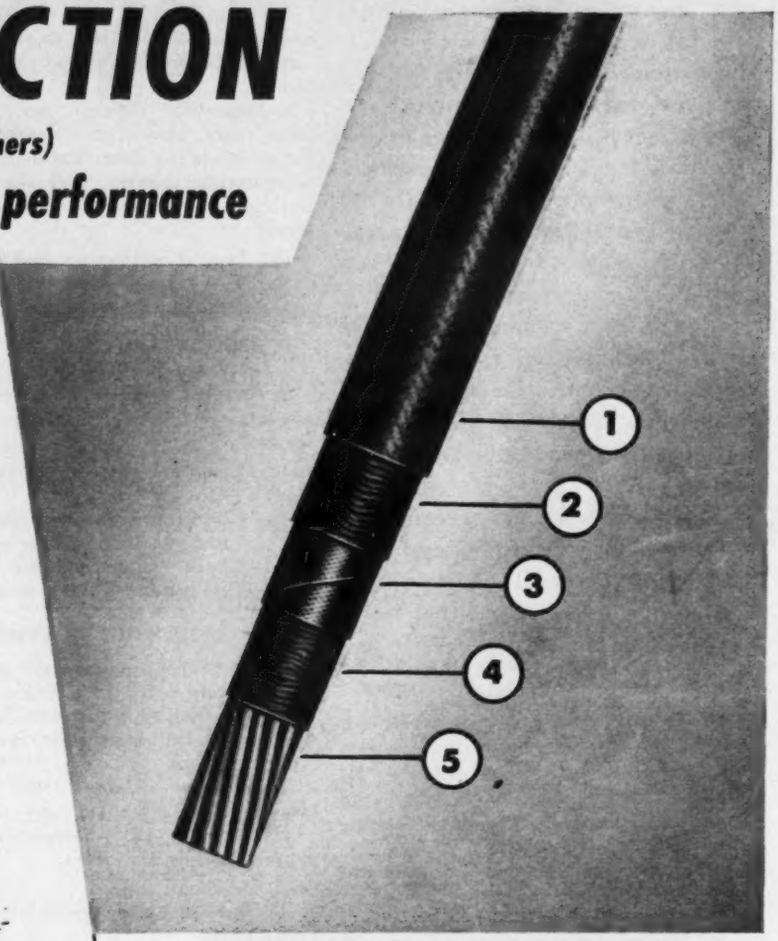
assures long-lived wire performance



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No. 18 A.W.G. to 1,000 MCM
Underwriters' and N.E. Code, Type AVA—maximum
operating temperature 110° C.

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1 A tough, rugged, smooth-finished asbestos braid impregnated with heat, flame and moisture resistant compounds to make a non-deteriorating, heatproof, fireproof jacket, highly resistant to oil, grease, moisture and corrosive fumes.

2 Outer felted asbestos insulation impregnated with heat, flame and moisture resisting compounds. Acts as a heat-barrier against high ambient temperatures.

3 Lubricated varnished cambric for high dielectric strength and high moisture resistance, protected from heat, flame and oxidation between two felted asbestos walls.

4 Dense felted asbestos insulation impregnated with heat, flame and moisture resisting compounds will not dry out, bake brittle or crack with vibration. Withstands conductor-heating overloads and won't burn even when exposed to copper-melting arcs.

5 The conductor is *perfectly* and *permanently* centered in helically applied insulation that stays put and will not migrate or flow under the action of heat, oil, grease, etc.

RESISTS moisture, oil, grease and fumes
WON'T bake brittle, burn, flow or rot

Permanently insulated Rockbestos A.V.C. wires, cables and cords, developed for trouble-free operation under severe operating conditions such as in circuits that run around steel mills, soaking pits, hot forging presses, boilers, steam tunnels, etc. are available in a wide range of sizes and types. Special wires for unusual applications will be designed to meet your requirements. Rockbestos Research will gladly assist you in the selection of the right wire for that difficult wiring problem. Write nearest branch office or:

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SUBSTATION INSPECTION, MAINTENANCE

As a guide and reminder to operators and others concerned in keeping substation equipment in good order and condition, this general inspection and maintenance schedule was recently drawn up for the system of the Virginia Public Service Company. The system consists of several divisions, each responsible for operation and maintenance within the division and with over-all supervision by the general operating office. Since adequacy of inspection and maintenance is a matter of local responsibility, each division had built up its own methods and practices for this important work. Naturally there were variations in routines between divisions.

This schedule was erected to compose these variations and thus to facilitate over-all system operation.

POWER, POTENTIAL AND HIGH-VOLTAGE INSTRUMENT TRANSFORMERS

1. General inspection, at intervals not exceeding one year or less if necessary.

(a) Test oil and filter if necessary. If chemical analysis appears necessary send one quart sample to designated testing laboratory.

(b) Check temperature indicators and clean oil level gauges.

(c) Check cooling equipment.

(d) Clean bushings.

(e) Check oil valves for leaks and drain off any water.

2. Overhaul, at intervals not exceeding five years.

(a) Insulation test (windings and bushings).

(b) Check transformer numbers, bushing numbers and tap changer positions against card records.

(c) Inspect ground, bus connections, terminals, etc.

(d) Test bushing oil and ground resistance.

OIL CIRCUIT BREAKERS

(22,000 Volts and Above)

1. Inspection interval, not exceeding one year; also when necessary, depending on operating duty. *Dispatcher will be responsible for records and inspection intervals.*

(a) Inspect mechanism and contacts.

(b) Test oil and filter if necessary.

(c) Clean bushings.

2. Bushing insulation test and test bushing oil, approximately five years.

OIL CIRCUIT BREAKERS

(Below 22,000 Volts)

1. Set up record of O.C.B. inspection and operations. *Division engineer will be responsible for records and inspection intervals.*

2. Inspection interval, not exceeding three years; also when necessary depending on operating duty. Variations in type, interrupting capacity and duty require individual attention for inspection interval.

(a) Inspect mechanism and contacts.

(b) Test oil and filter if necessary.

(c) Clean bushings.

STATION AND LINE VOLTAGE REGULATORS

1. External inspection interval not exceeding one year covering following items:

(a) Complete inspection and lubrication.

(b) Check operating mechanism.

(c) Check no load voltage setting.

(d) Check contact making voltmeter.

(e) Test oil and filter if necessary.

LIGHTNING ARRESTERS

Oxide film—Inspection interval not exceeding one year. (See Engineering Department Operating Instructions No. 160)

Thyrite—Inspection interval not exceeding five years.

Auto Valve—(Before 1939) Inspection interval not exceeding one year. Auto Valve—(After 1939) Inspection interval approximately five years.

1. Overhaul.

2. Test grounds electrically and mechanically.

CABLES

Inspection interval one year.

1. Check ampere loading and temperature.

2. Insulation test.

3. Clean manholes.

4. Check pot heads and terminals.

5. Check sheath grounds.

CONSTANT CURRENT TRANSFORMERS

1. Visual inspection every six months.

(a) Check guides and stops.

(b) Clean plugs and check connections.

(c) Check ampere loading with transformer rating.

2. Overhaul, at intervals not exceeding five years.

DISCONNECT DEVICES AND BUS STRUCTURES

Inspection interval approximately one year (during prearranged interruptions for other work).

1. Inspect single blade disconnects.

2. Inspect, lubricate and adjust gang-operated disconnects and pole top switches.

3. Inspect flexible shunts and flexible leads on air break switches, disconnects.

4. Inspect H. T. and L. T. fuses, fuse clips and cutouts.

5. Inspect bus support insulators and bus connections.

SYNCHRONOUS CONDENSERS

1. Monthly or as needed.

(a) General inspection and cleaning.

(b) Inspect commutator and brushes.

2. Inspection interval not exceeding one year.

(a) Lift end shields, inspect and blow out windings.

(b) Megger windings.

(c) Check bearings.

ROTARY CONVERTER

1. Monthly or as needed.

(a) General inspection and cleaning.

(b) Inspect commutator and brushes.

(c) Blow out windings.

2. Inspection interval not exceeding one year.

(a) Megger windings.

(b) Check bearings.

(c) Paint if needed.

GENERAL NOTES

1. *New oil* should have dielectric strength of about 28 kv. Oil with dielectric strength below 25 kv. should not be used until filtered; (28 and 25 kv. based on adjustment of test results for applied voltage). Spark gap shall consist of two disks, 1 in. diameter with flat faces and square edges spaced 0.1 in. Oil that has been used in oil circuit breakers shall not be used in transformers, regardless of test value. Oil of different grades shall not be mixed and in general old oil shall not be added to containers with new oil.

2. Test all substation grounds, making sure all grounds are tied together and that fences are tied into ground. Improve grounds of greater than 5-ohm resistance.

ATTENDED SUBSTATIONS

1. Complete and thorough inspection by the operator once each shift.

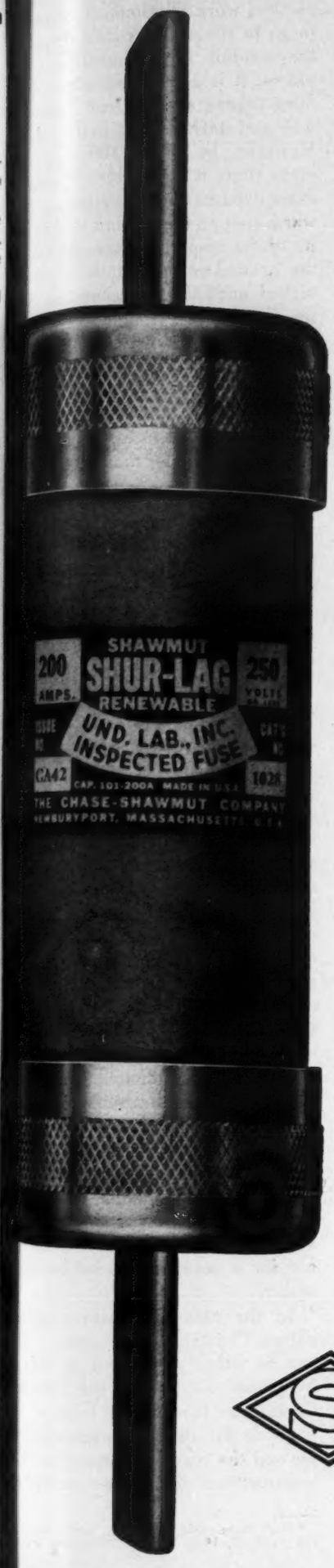
2. Special instructions—every hour the operator must take transformer temperatures and check transformers and oil circuit breakers for oil leaks.

3. Inspection by division engineering employees at every three-month interval.

UNATTENDED SUBSTATIONS

1. Inspection by division engineering employees at three-month intervals.

2. Inspection by local serviceman, line foreman, district manager, district engineer or other responsible division employee, once a week or oftener.



FIFTY YEARS

OF QUALITY IN THE MANUFACTURE OF ELECTRICAL EQUIPMENT FOR CIRCUIT PROTECTION

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SHAWMUT IS THE WORD FOR FUSES

THE CHASE-SHAWMUT COMPANY
NEWBURYPORT, MASSACHUSETTS

D.C. on Live A.C. Bus to Locate Grounds

By W. C. NODDINGS
Master Mechanic and Electrical Engineer, Raritan Copper Works, International Smelting and Refining Company, Perth Amboy, N. J.

By superimposing direct current on "live" a.c. power lines a ground may be located in a very short time and with little expense or difficulty. The method can be used to advantage on industrial plant low-voltage distribution systems where there are many circuits tied to a common bus through oil switches, none of which could be opened without seriously interfering with plant operation. This method has been found to work best with a solid ground, but many times even an intermittent ground becomes solid when direct current flows in the circuit.

The ground-locating method explained here has been used successfully many times at the Raritan Copper Works plant of the International Smelting & Refining Company, Perth Amboy, N. J., often locating grounded spots in conduit circuits.

Referring to the illustration a 440-volt, three-phase power bus has a number of feeders connected through oil switches that can seldom be opened while in service. Consider a ground occurs on the system, indicated by all lamps being dark in the A leg and by lamps being brighter than usual in the B and C legs of the ground indicator on the main bus.

A motor-generator set is used to supply direct current for locating the ground; the negative side is solidly grounded and the positive side is connected through a suitable switch and fuse to the grounded phase conductor at any convenient point on the system.

Amount of direct current is adjusted to approximately 100 amp. as indicated by a d.c. ammeter in the generator circuit. If the generator has a separately excited field controlled by a potentiometer rheostat the switch connecting the d.c. generator to the a.c. line can be closed with about 10 volts on the generator and the voltage then raised until the direct current reaches 100 amp.

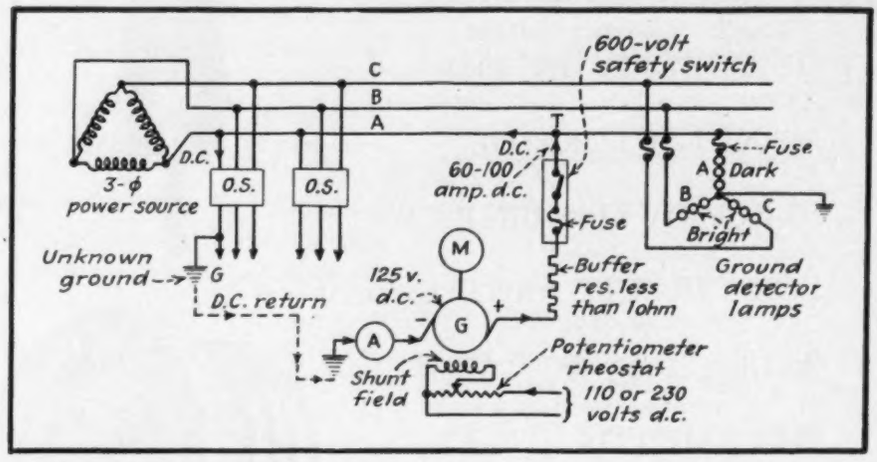
When the generator switch is closed the direct current flows on the "live" a.c. power line, seeking the ground return circuit, just as it would if there was no alternating current in the power lines. Wherever the direct current encounters an alternating current, the former is merely superimposed on the latter in that part of the circuit.

There will be practically no alternating current flowing through the d.c. generator as there will be very little a.c. voltage drop between the tap T and the unknown ground G.

The direct current superimposed on the live a.c. lines may be followed by using a compass or a magnetized needle hanging on a thread. Wherever direct current is flowing in the line the needle will deflect in opposite direction on the top and bottom of the wire. The other two a.c. lines will not affect the needle, so a man can thus follow the direct current along the line as fast as he can walk to the ground at point G. A current as low as 5 amp. can be followed with the needle, but 60 to 100 amp. will be about the correct amount for the best results.

Flow of direct current can even be followed when the conductors enter a conduit. If the conduit is grounded on steel work all along, it is possible to go to the exact grounded spot, but if the conduit is grounded at a few places, it is a little difficult to determine where the current leaves the wire and starts flowing in the conduit. However, by using 100 amp. d.c. many times it is possible to locate the exact grounded spot, by feeling for a warm spot on the conduit in the vicinity of the suspected area. As soon as the ground is located, it is not disturbed until the d.c. generator is off the line.

Although this method for locating grounds has not been tried on 2,300 volt circuits, there would be no hesitancy to do so, but then an oil switch and a D & W oil fuse should be used in the "hot" line of the d.c. generator.



CONNECTIONS for superimposing direct current on live a.c. bus to locate ground

Series Capacitors—Where Place? How Big

Effect on Equipment*—IX

By S. LUBIN
Engineer, REA Technical Standards Division

Introduction of a series capacitor may sometimes cause "self-excitation" of induction motors supplied by the line. This can be eliminated by shunting the capacitor with a high resistance. The loss introduced by such a resistance is generally less than 10 percent of the line loss. However, the "self-excitation" of induction motors on distribution circuits due to series capacitance is a rare condition, since the existence of other loads between the capacitor and induction motor produces the same effect as shunting the capacitor with a resistance. Judicious location of the capacitor so that some load intervenes between it and the induction motor can nearly always prevent "self-excitation." In general, when the capacitive reactance is less than one-half the system short-circuit reactance "self-excitation" will not occur for a normally loaded induction motor.

In the case of synchronous machines "hunting" may result. This can be either eliminated or reduced by proper location of the capacitor. Conditions for proper location and methods for their determination are beyond the scope of this series. The manufacturer should be consulted for

* Final installment of series, which began in the April 17, 1943, issue of "Electrical World."

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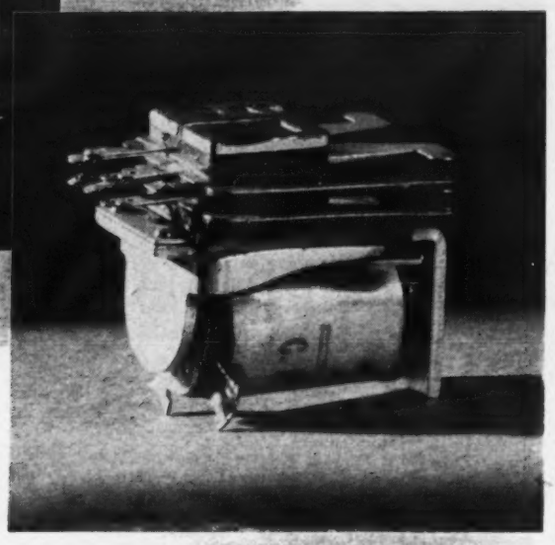
CLARE Type K d.c. Midget Relay



HERE IS A "CUSTOM-BUILT" RELAY *after* 59,000,000 *Operations*

Here is what "custom-building" means in terms of long life and rugged dependability.

This is a Clare Type K d.c. Midget Relay, still in good mechanical and electrical condition after 59,448,200 operations. It has been used for "pulsing" relays, set for 16 operations per second, energizing a secondary relay having a 90 ohm coil operating on 28 volts.

This tiny relay, measuring only 1½" x 1¼" x 13/16" and weighing approximately 1⅔ ounces, is "custom-built" into a solid, compact unit, employing no anti-vibration springs, no bearings to rattle loose—"custom-built" to do a specific job and to assure the accuracy, ruggedness and serviceability which that job demands.

That principle of "custom-building" relays avoids the rigid limitations of ordinary relays and assures the flexibility of application so important in modern designing. And "custom-building" relays is meeting design requirements of today in such a way that the requirements of tomorrow will develop naturally through the application of the same basic principle.

As you develop new applications, let our engineers "custom-build" the relay that meets your specific requirements. Ask for the Clare catalog and data book. C. P. Clare & Co., 4719 Sunnyside Ave., Chicago, Ill. Sales engineers in all principal cities. Cable address: CLARELAY.

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"Custom-Built" Multiple Contact Relays for Electrical, Electronic and Industrial Use

this information when capacitor stallations are planned on a sy including synchronous machines.

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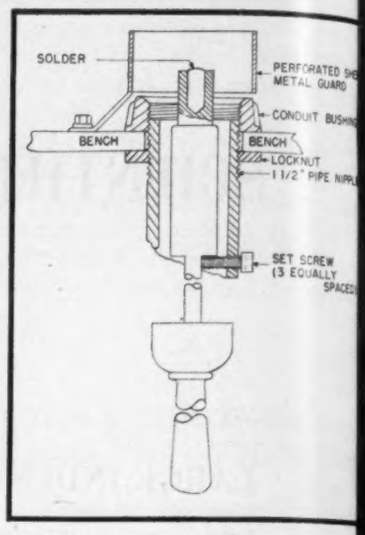
Soldering Iron Used as a Soldering Pot



Adaptation of standard solder irons and small soldering pots facilitated the production of sa instrument-type motors in one General Electric Company's pla The irons are saving materials, cause they present only a very sm area for oxidation.

The improvised solder pot, wh was developed by R. H. Bainbrid a foreman, is easily built. A stand medium-size soldering iron tip faced off flat and drilled with a in. diameter hole, ¾ in. deep. This is reassembled to the soldering ir The iron is then mounted vertic in a hole in the bench so that the projects about 2 in. above the t

The mounting is made perman by the use of a standard pipe nip locked from the top with an elec cian's conduit bushing and from bottom with an electrician's lockn The iron is held in the bushing three setscrews which clamp body of the iron proper.

Only the insulation contained the iron itself is required for effici operation. A perforated sheet-me guard which encircles the expo tip permits free circulation of about the tip, eliminating the po bility of overheating the solder. at the same time assures complete erational safety by guarding agai accidental contact with the hea tip.

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Two Years' Driving with No Time Out

. and this FWD is still going strong

p-and-go short hauls day afer day, with 12-ton loads, is ough test for *any* truck.

But this FWD in Appleton, Wisconsin, has been on the for two years in just that kind of service. This FWD is ned by P. J. Heenan, owner and operator of the Eastern nsportation Co. "Not since we purchased this truck ve we been tied up or lost time," writes Mr. Heenan.

Mr. Heenan purchased this FWD truck (a T-26 tractor) August, 1941. It is used daily on Eastern's Manitowoc- pleton run. In over 50,000 miles, the gasoline economy this short haul averaged 4.6 to 5 miles per gallon, with ds up to 12 tons.

Extra ruggedness and dependability are built into FWD cks. Owners know that FWD's never become "orphans" that progressive interchangeability of vital parts keeps WD's in service far beyond normal expectancy.

The full-powered traction of four driving wheels is al for today's transportation tasks. See your FWD branch dealer and get the whole story.

HE FOUR WHEEL DRIVE AUTO COMPANY
CLINTONVILLE, WISCONSIN
Canadian Factory: Kitchener, Ontario

Mr. P. J. Heenan, owner and operator of the eastern Transportation Co., keeps in touch with operations. He's always "on the go," like his FWD.

The True Four-Wheel-Drive Principle With Center Differential Asks Less In: Tires — Gas — Oil — Replacements.

OMMERCIAL CONSTRUCTION UTILITIES OIL FIELDS MILITARY

FWD TRUCKS

EVERY FIELD WHERE TRUCK QUALITY IS PUT TO THE TEST — FWD's STAND UP!

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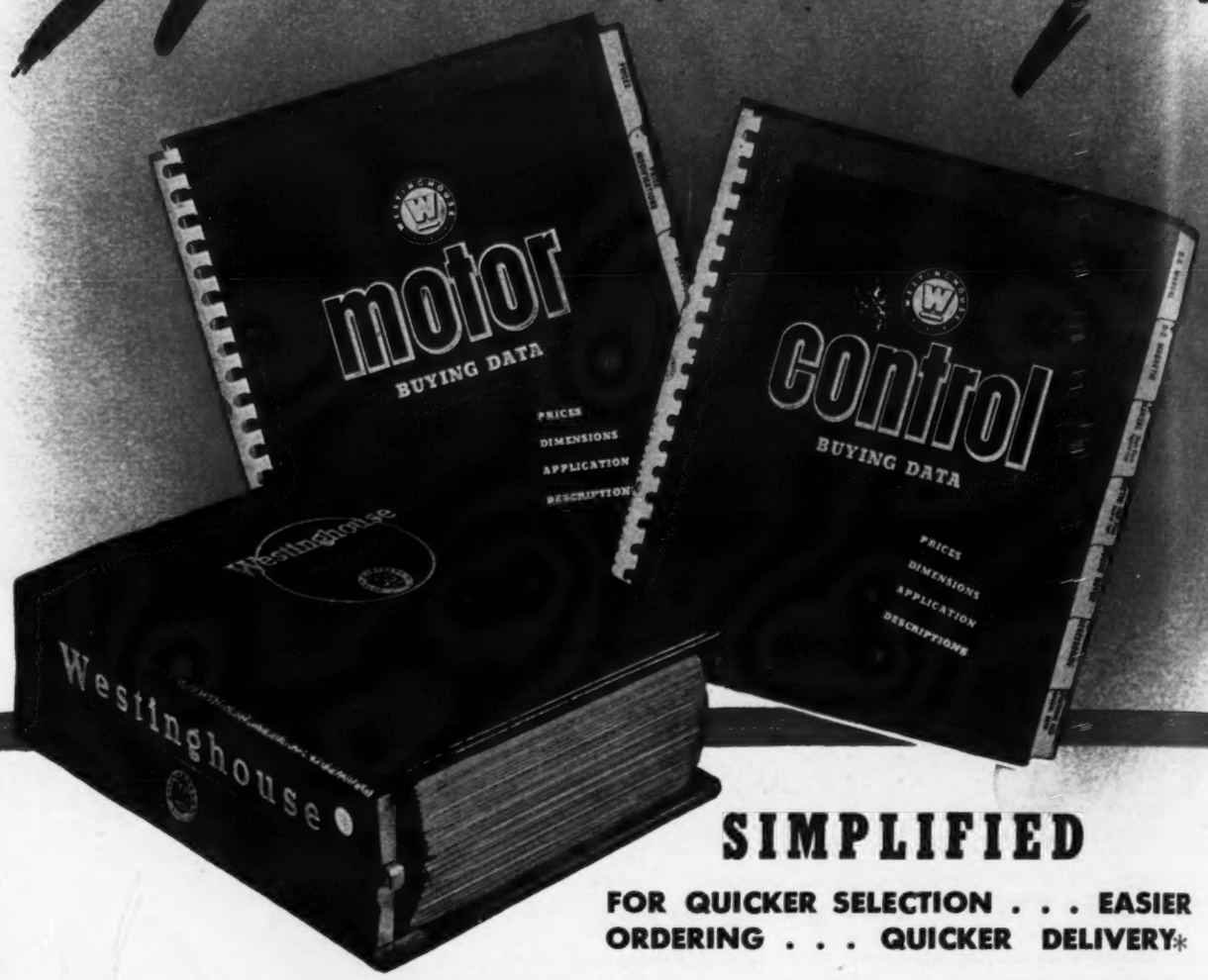

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• **Motor and Control Loose-Leaf Book.** This is for the use of large-scale purchasers and is "tailored" to meet the needs of the individual buyer. It contains more complete product listings than the bound books, plus a wealth of information on special features required for specific industries. Pricing data is always kept up to date by the issuance of new price supplements.

*. . . time saved in selection and ordering . . . use of standard instead of special equipment . . . means faster deliveries and more man-hours available for war work.

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Buying Data

THAT REDUCES MOTOR AND CONTROL SELECTION AND ORDERING TIME

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"More work from fewer man-hours" is one of America's greatest needs today, for every hour saved is another step toward Victory.

Consequently, Westinghouse takes pride in introducing new, simplified Buying Data, which enables you to select and purchase the proper motor and control for your job—in one-half the time!

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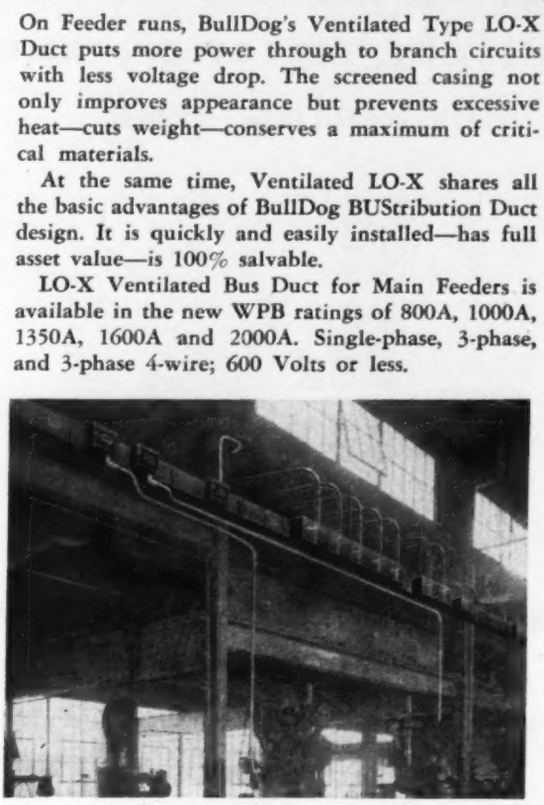
Yet It Saves Much Steel and Copper In Conformity with WPB Limitation Order L-273

On Feeder runs, BullDog's Ventilated Type LO-X Duct puts more power through to branch circuits with less voltage drop. The screened casing not only improves appearance but prevents excessive heat—cuts weight—conserves a maximum of critical materials.

At the same time, Ventilated LO-X shares all the basic advantages of BullDog BUStribution Duct design. It is quickly and easily installed—has full asset value—is 100% salvable.

LO-X Ventilated Bus Duct for Main Feeders is available in the new WPB ratings of 800A, 1000A, 1350A, 1600A and 2000A. Single-phase, 3-phase, and 3-phase 4-wire; 600 Volts or less.

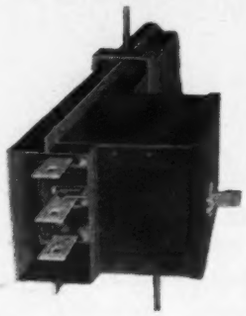


Flexible Light and Power

(Above) This shows a Branch Circuit run of BUStribution DUCT with circuit protective devices plugged in at points most convenient to the machines they energize and protect. Each 10-ft. section of plug-in duct has 10 outlets for the insertion of these plugs, which can be readily moved with the machines and instantly plugged in at any other desired location. It is 100% flexible and salvable.

Capacities available under new WPB standards are 250A, 400A and 600A for branch runs of Plug-in Bus Duct.

Plug-in Type for Branch Circuits



(Right) End view of a branch circuit plug mounted on a bus duct section. Note how the copper "contact fingers" of the plug, inserted through a plug-in opening in the duct casing, clamp over the busbars in the duct.

Wiring between plugs and machines is made in short runs of rigid or flexible conduit.

Plugs may be of the fusible switch type or automatic circuit breaker type and are readily interchangeable. Capacities: 30A to 600A; 600 Volts or less.

MANUFACTURERS OF a complete line of Vacu-Break Safety Switches, Panelboards, Switchboards, Circuit Master Circuit Breakers and BUStribution SYSTEMS.

BULLDOG ELECTRIC PRODUCTS CO.
Detroit, Michigan
BullDog Electric Products of Canada, Ltd., Toronto, Ontario
Field Engineering Offices in All Principal Cities

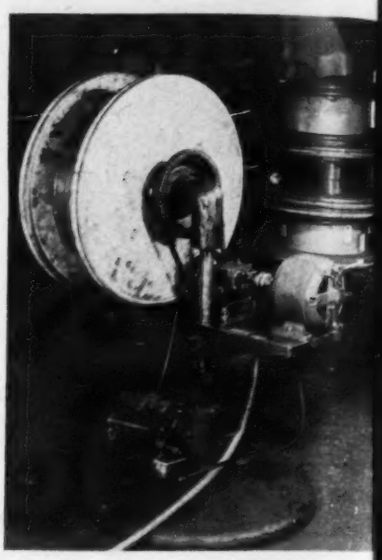
You SAVE when you SPEND on WAR BONDS

Unreeling Device Regulates Bar Stock

By LAWRENCE G. BERGSTROM
Westinghouse Electric & Manufacturing Compa
Mansfield, Ohio

Cutting and straightening of sma commutator bars can be done wi little or no special attention by a ma chine designed for use in the Man field, Ohio, plant of the Westinghou Appliance Division. For econom reasons the copper bar stock is fu nished on a reel. Approximate 5,000 segments per hour can be c and straightened. Six different siz can be handled by the machine wi its present complement of rolls.

In processing the bars it is nece



LOOP of commutator bar stock below r operates switch arm and motor, and el inates back pull on stock paying off top of reel to straightening rolls on cut machine

sary to stop the travel of the b stock through the straightening rol while a knife cuts off a segment. Th stopping and starting former caused a jerky motion on the re which caused the reel to over-trav and unwind too much copper, oft resulting in tangled copper and duced output of the straightenin machine.

To eliminate this trouble a stan ard unreeler was redesigned to op ate in co-ordination with the m chine. This unreeler is shown in t accompanying illustration.

A loop of the bar stock is pass under an arm which operates a m cury switch controlling the ¼-h motor used to drive the mechanis

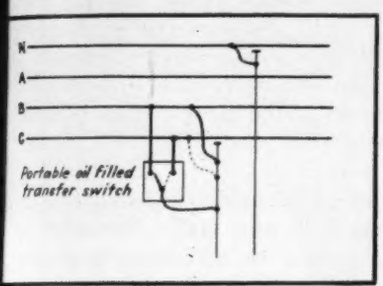
the straightener pulls the bar rough the roll the bar loop becomes naller and lifts the switch arm and arts the motor, to unwind the bar om the reel. As the reel turns and e bar unwinds the loop becomes rger, letting the switch arm drop shut off the motor.

The motor operates intermittently as to maintain the bar loop at a redetermined size, which eliminates l back pulling on the straightening olls. Speed of the motor is cut down rough the use of a small reduction ear unit.

•

A Safer Way o Transfer Taps

For transferring single-phase anch line connections from one hase to another, in balancing the hase loads on feeders, Wisconsin lectric Power Company linemen od that a small, portable oil-filled ansfer switch is helpful and a lot fer than breaking and making the hase connection by hand. The trans-



MALL portable oil switch as used for ansferring branch line taps from phase phase

er switch they use weighs 50 lb. or ss. In essence it is a single-pole, louble-throw switch operating under il.

As shown, the center pole is con-ected to the phase side of the branch ine. The two other terminals are onnected one to the phase feeding he branch (shown dotted); the ther, to the phase that will feed the ranch (shown solid). With the witch closed to parallel the existing onnection the jumper is cut. The witch is then thrown to the other osition and the new jumper is in-talled, completing the transfer.

Thus the customers suffer no out-ges. They are, in fact, unaware that ny work is being done on their lines.

"LUBRI-TACT" PORCELAIN TUBE RHEOSTATS

"JAGABI" RHEOSTATS
. . . for ACCURATE Current Control

Jagabi Rheostats combine ruggedness of construction with instrument accuracy. From the smallest to the largest size, they permit the fine adjustment that is necessary for the proper control or functioning of equipment with which they are used.

Jagabi Lubri-tact Rheostats have a unique lubricated positive sliding contact and are made in four sizes and seventy-six ratings. Available also with screw adjustment and in metal-cage types for switchboard or table mounting.

Jagabi Compression Carbon Rheostats can be smoothly controlled by screw adjustment and overloads of several hundred percent are permissible for short periods of time. Four sizes in current ratings from 6 to 65 amps. up to 55 to 800 amps.

For descriptive material and data write for Rheostat Bulletin 1705-W'E

JAMES G. BIDDLE CO.
1211-13 ARCH STREET • PHILADELPHIA, PA.

"JAGABI" COMPRESSION-CARBON RHEOSTATS

LOAD SERVICING

Industrial • Commercial • Rural • Residential

Links War Effort to State Economy

Through the medium of an amateur motion picture in color, entitled "Oklahoma Gears for War," the Public Service Company of Oklahoma by combining a pictorial record of the company's electrical facilities with a broad and graphic story of what Oklahoma industry and agriculture are doing to win the war is telling the people of the state about its contributions to the war effort.

Emphatic testimonial that the picture is doing the job is seen in attendance records. Since January 30, 1943, the picture has been shown to 122 audiences totaling 27,800 persons. The picture is already booked into summer months, according to announcement of J. P. Arnold, head of the company's public affairs department.

"Oklahoma Gears for War" is a 1,100-ft. picture, 16 mm., and runs 34 minutes. It is enlivened by occasional music, contains some silent titles and is supplemented with a descriptive talk explaining the processes in detail.

The picture opens with an exterior shot of a power station. From a pile of coal, coal is picked up and goes to a battery of furnaces. The audience next is shown the inside of a turbine and then taken to a substation, where the energy begins its trip to the home.

Fortification of electrical service through use of three fuels—all Oklahoma products—is stressed. Different plants, substations, transmission lines of the company, a short sequence explaining the underground system and a picture of officers of the company visiting a home service kitchen are included. A hot stick sequence has proved exceptionally interesting.

The audience then is taken to a coal mine, where electrically operated shovels dig coal. Oil wells and oil refineries, electrically operated, follow. Manufacture of oil field tools, glass jars, brick, lead and zinc are portrayed in detail.

Other industries visited include cotton production, a paint factory, flour and feed mill, cement mill, sawmill, bakery and packing house, chicken hatchery, electric milking and pasteurization, soft drinks, newspapers.

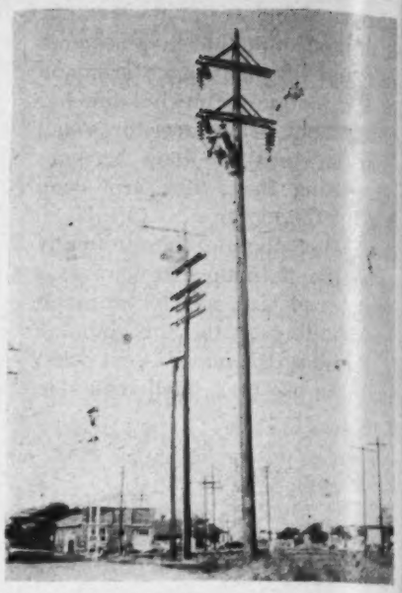
Tying the picture further to the war effort, the method by which scrap and junk finally find their way into a gun or a bullet or a weapon of war is shown, from the pressing of automobile bodies and other metal into small bales to the furnaces, where the metal is heated by electricity and poured into molds.

Other highlights of the picture not directly related to the industry, but of current and news value, are pictures of a federal Indian hearing, a cowboy statesman, and full detailed pictures of the inauguration in January of Oklahoma's Governor, Robert S. Kerr.

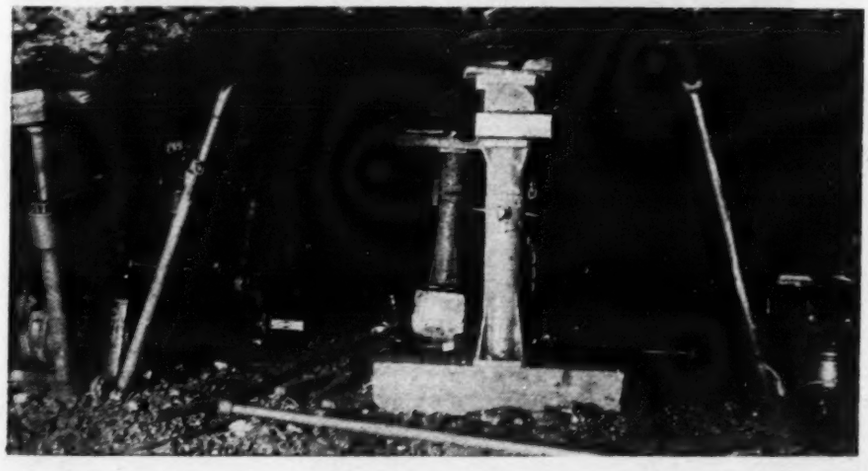
All photography was done by the company's own staff. Narration of the picture to audiences large and small, in hamlets and cities served by the company, is also done by members of the public affairs staff of the company. Sufficient footage was taken to permit showing of extra film with local color and local personalities in the various districts where the picture is shown.

Supplementing the company's story of itself and Oklahoma industry in the war, neat booklets prepared by the company's advertising department giving information on Oklahoma's agricultural and mineral resources and manufacturing facilities are distributed to those who attend the meetings.

The picture, because of its general appeal and because of intense interest generated by the war production, now is touring the company territory of eastern Oklahoma and day by day is becoming more and more in demand.



OF SPECIAL INTEREST to laymen audiences is the hot stick continuity, which shows a crew of men using the sticks on a 33,000-volt line



SCENE IN A COAL MINE—Both strip mines and slope are shown. This scene shows an "avenue" deep in a mine, with an electric cutting machine at the right. The company has facilities for using 180,000 tons of slack coal, from Oklahoma mines, each twelve months

WAGNER PRODUCTS *SPEED* VICTORY

1000-K V A UNIT SUBSTATION WITH NOFLAMOL TRANSFORMER, 13,200 to 480-VOLT, 60-CYCLE, THREE-PHASE.

Wagner
UNIT SUBSTATIONS

are doing their part in the production of steel, synthetic rubber, oil, and other vital materials

The Unit illustrated above is installed in a synthetic rubber plant. The transformer has a two-position liquid-filled disconnecting switch on the high-voltage side which is equipped with low-voltage interlock. The low-voltage side is equipped with air-break circuit-breakers electrically or manually operated, ground indication lights, voltmeters, ammeters, and ammeter test blocks. Unit has one main breaker, one tie transfer breaker, and four feeder breakers.

For Complete Information on Wagner Unit Substations write or phone the nearest Wagner branch office.

Wagner Electric Corporation

ESTABLISHED 1891

6456 Plymouth Avenue, St. Louis, 14, Mo., U. S. A.

ELECTRICAL AND AUTOMOTIVE PRODUCTS

T43-5

Another Example of Kelvinator's

New "Wartime Idea Exchange" Announced for

$1,000 IN WAR BONDS IS MONTHLY AWARD FOR BEST NUTRITION IDEAS

Government Specialists to Act as Advisers and Judges

A $25.00 War Savings Bond will be awarded each month by Kelvinator to each of the originators of the forty best ideas submitted in Kelvinator's new "Wartime Idea Exchange" Project.

Dr. M. L. Wilson

Because this new Kelvinator program represents such an important and fundamental contribution to the war effort, and particularly in view of the home-front problems facing housewives today, important government food and nutrition experts who are working on these same problems have been happy to lend their aid and counsel. As a result, Kelvinator has selected a Board of Judges to choose the forty most helpful ideas each month —and to act as a Board of Advisers, as well, in setting up the monthly projects which will be of greatest current interest to the women of America. The nationally-known specialists who form Kelvinator's Board of Judges are:

Dr. Louise Stanley

G. E. Farrell

DR. M. L. WILSON, Nutrition and Food Conservation Chief, Nutrition and Food Conservation Branch of the Food Distribution Administration, Washington, D. C.

Dr. LOUISE STANLEY, Special Assistant to the Administrator, Agricultural Research Administration, Washington, Dist. of Columbia.

GEORGE E. FARRELL, Principal Agricultural Specialist, United States Department of Agriculture, Washington, D. C.

Gertrude Warren

MISS GERTRUDE WARREN, Senior 4-H Group Organizer, Specialist in Extension Service, United States Department of Agriculture, Washington, D. C.

Mrs. P. L. Crowlie

MRS. PHILIP L. CROWLIE, Typical American Housewife, Office of Price Administration, Washington, D. C.

Kelvinator Is Building Now For Post-War Business

The tremendous amount of consumer good will that accrues to Kelvinator and Kelvinator merchants through the new "Wartime Idea Exchange" Project will pay sound dividends when Kelvinator again has merchandise to sell. Today housewives need all the help they can get with the new problems that arise in feeding their families and conserving household equipment. Home Economists are the finest source of practical new ideas for solving these problems. Kelvinator's contribution is bringing the two together. In performing a valuable service today to our government, to Home Economists and the nation's homemakers, this Kelvinator program will have the eventual result of building post-war electric range and refrigerator sales.

NATION'S HOUSEWIVES, KELVINATOR DEALERS TO BENEFIT

Through this Kelvinator program, the housewives of the nation will receive the full benefit of the alert minds of the Home Economics profession, as their training and professional skill are brought to bear on the wartime problems confronting homemakers daily.

The best ideas of the nation's Home Economists on such typical subjects as "Aids to Home Preservation of Fall Vegetables and Fruits," the first monthly project assigned, will be published in the monthly bulletin, "Helps for Homemakers." The timeliness of these ideas of the country's experts on home problems will make this an eagerly sought for item by housewives in every community. For Kelvinator retailers the bulletin provides an ideal means of giving a vital wartime service to consumers, and building future good will for them.

SCRAP IS POWER

Cooperate With Your Industry! Salvage All Inoperative Parts Containing Critical Materials . . . Put Vitally-Needed Scrap Back Into the Scrap TODAY!

ETAIL-MINDED ACTION

Exchange" Project for Home Economists!

DEALERS WILL DISTRIBUTE TO HOMEMAKERS BEST IDEAS OF LEADING HOME ECONOMISTS TO FURTHER GOVERNMENT NUTRITION PROGRAM

Kelvinator, through its Kelvin Kitchen, announced to Home Economists in June the inauguration of a new program called the "Wartime Idea Exchange" Project. Designed as a clearing house and stimulant for outstanding new ideas on nutrition and conservation to further the government's national program, the plan calls for monthly projects of immediate interest to homemakers, and the awarding of $1,000 in War Savings Bonds for the forty best ideas originated by leading home economists on the subjects assigned.

Monthly Bulletin for Home Economists and Homemakers

Monthly "Kelvin-Gram"

The promotion plan is built around a monthly bulletin, the "Kelvin-Gram," which will be published as a four-page insert each month in one of the leading publications of the Home Economics profession, "What's New in Home Economics." In addition to announcing the new project of the month, the "Kelvin-Gram" will carry two pages of last-minute Washington news notes of the month's outstanding home-front food problems of especial interest to Home Economists, together with suggestions from the Kelvin Kitchen for meeting and presenting these problems to the nation's homemakers.

Special Bulletin for Retailers' Use

The nub of the plan from the dealers' viewpoint is the publication of the outstanding ideas received from each monthly "Wartime Idea Exchange" Project in a pamphlet entitled, "Helps for Homemakers." These will be available to retailers, Home Economists and utilities for use in their direct contacts with consumers. In addition, these ideas will be sent to 700 radio stations for use on their daily domestic science and women's programs.

Announced in the June issue of "What's New in Home Economics," the first project has already aroused great enthusiasm and every mail brings ideas for the Exchange Project and requests for additional copies of the "Kelvin-Gram."

LOOK AHEAD WITH KELVINATOR
DIVISION OF NASH-KELVINATOR CORPORATION
Kenosha · Milwaukee · DETROIT · Grand Rapids · Lansing

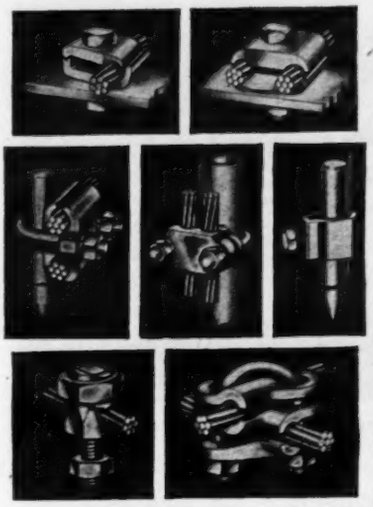
"You can get **ANY** Grounding Connector—

—in the **COMPLETE** line."

The pictures below can only give you an idea of the variety, because **Penn-Union makes ALL good types.**

Write us for any grounding connector, clamp or stud . . . for all combinations of pipe, rod, flat bar, cable, braid, tubing.

Every one a *dependable* unit of protection for personnel and equipment . . . of ample capacity, high mechanical strength, and resistant to corrosion.

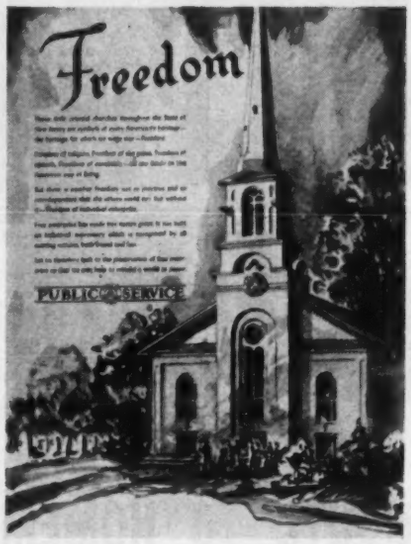


Also the most complete line of Service Connectors, Cable Taps, Terminal Lugs, Tees, and other fittings. *Penn-Union connectors are the choice of leading utilities, industrials, contractors and electrical manufacturers.* Write for Catalog.

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
Conductor Fittings

Interdependent



Public Service Electric & Gas Company advertises the interdependence of the freedom of speech, of the press, of assembly, of religion and of individual enterprise in the communities of New Jersey where it serves.

•

Poster Warns "Kids" to Fly Kites Safely

This spring, and for the tenth consecutive year, as the kite flying season rolled around, Wisconsin Public Service Corporation, Green Bay, admonished the "kids" in its territory to "fly your kites and have fun, but stay away from wires." The company used the cartoon poster shown to carry the message.

In the poster a specific warning is given "never to use tinsel cord or wire for kite string—not to climb poles or throw sticks or stones to loosen a tangled kite."

This cartoon poster has been distributed to city and rural schools, where complete cooperation, as in past years, has been had from instructors and principals. Posters also appear on service trucks and in car space in all company-owned city and interurban buses as well as in stores and show windows of company offices.

A reproduction of the poster in smaller size for newspapers has been scheduled in some 35 daily and weekly newspapers.

•

Utilities See Farmers Vital to War Program

Operating companies of the New England Gas & Electric System, with headquarters at Cambridge, Mass., have launched advertising presentations in 30 territorial newspapers with the object of increasing public realization of the critical importance of farming in the prosecution of the war. The areas covered range all the way from Calais, Me., to Cape Cod and include both urban and rural utilities. It is felt that a wider appreciation should be had of the basic necessity of agriculture in relation to all fronts from the battle lines through industry to the civilian population which supports and finances the struggle against the Axis powers.

The two advertisements reproduced are keyed upon this theme and proclaim the vital interest of these utilities in the problems of the farmer and their recognition of the support which he deserves. Even city

KIDS!
FLY YOUR KITE
HAVE FUN..
But
STAY AWAY FROM WIRES
NEVER use tinsel cord or wire for kite string ... fly away from overhead wires ... DO NOT climb poles or throw sticks or stones to loosen a tangled kite.
WISCONSIN PUBLIC SERVICE CORPORATION

HAVE FUN but play safe is theme of utility poster warning junior (or senior) kite fliers

Cover has been removed from the 100-ampere G Frame Nofuze "De-ion" Breaker to show how the interchangeable trip unit can be removed without disturbing other parts of the mechanism.

Interchangeable TRIP UNITS

make NOFUZE BREAKERS adaptable for war or peace

Whether in khaki or "civvies", Nofuze Breakers provide circuit protection that can be accurately fitted to job conditions.

Today, when most Westinghouse Breakers are "mobilized" to protect war circuits, they are keeping current flowing *safely*, with minimum interruptions in war production.

When peace comes, with its equally great problems of conversion to civilian goods, Nofuze Breakers will permit economical and speedy change-overs. For example: In the larger frame sizes, trip units are removable and interchangeable. Thus if your conversion results in heavier or lighter loads, the present trip unit can be quickly replaced with one of the required trip rating. It's as easy as that.

Ask your Westinghouse representatives for help on *your* war circuit problems. Or write direct to: Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept. 7-N. J-60539

NOFUZE "DE-ION" BREAKERS

Prevent harmless overloads from interrupting war production.

Protect circuits from dangerous overloads and "shorts".

Restore service instantly with just a flip of the switch.

Westinghouse NOFUZE CIRCUIT PROTECTION

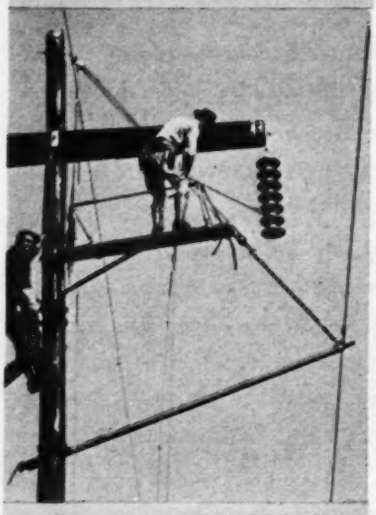
PLANTS IN 25 CITIES ... OFFICES EVERYWHERE

This "H" frame job shows the simplicity of hot line work with TIPS maintenance tools

Hot line tools need to be simple in operation and these pictures show how Tips Pivot Platform and Tips Wire Tongs with swivel pole attachment, can easily be moved to a variety of positions without dismounting this equipment from the pole. In the first illustration, the conductor has been released from the insulator and dropped to a safe position where it is held with wire tongs and an insulated Link Stick suspended from a set of rope blocks. The platform allows the lineman to walk out and make the necessary insulator changes. The other illustrations show how this equipment has been used for changing the outside insulators without altering the pole position of this equipment. Hot line tools should be selected for such maneuverability and Tips Tools are designed to give you this freedom of action plus safety for the operators. Cut the risk of long outages by outfitting maintenance crews with Tips Tools for quick, safe repairs while the power's on.

Instruction pages in this catalog show how to do 24 different hot line jobs.

Note here how the platform has been swung around to the side of the pole while linemen disconnect the conductor by using a Tips All-Angle Cog Wrench. Note the wire tong has been swung into position without changing its location on the pole.



Here the platform has been swung around to working position where it is locked in place. The lineman is using a Shepherd Hook to lift insulators.

A·B·CHANCE CO.
CENTRALIA, MISSOURI.

properties like Cambridge Electric and Worcester Gas share in this recognition that the man with the gun needs the man with the hoe, directly or indirectly, dependent as their populations and representatives in the services are upon outside agriculture.

Victory
Needs the Farmers
of New England and America

Let's not forget it is the farmer who produces the first and fundamental sinew of war—FOOD.

* * *

It is he who musters and directs those forces of food production that mean the subsistence of the men at the fighting fronts—our own subsistence as well.

* * *

Last year, with the demands of the armed forces and war industries diminishing his labor supply, the New England farmer achieved new production records.

* * *

This year, with even greater difficulties facing him, he is asked to increase his production even more.

* * *

A loyal citizen always, he is eager to do his full part.

* * *

A realist with hard common sense, he hesitates to make commitments until he can see how he can fulfill them.

* * *

He needs our understanding and our co-operation. He richly deserves both.

* * *

We are dependent upon him, not only for victory but for our very survival.

NEW HAMPSHIRE GAS & ELECTRIC CO.
PORTSMOUTH, N. H.

With the health and welfare of its employees, its customers and the community depending in large part upon sustained agricultural production, this Company is vitally interested in the New England farmer and his wartime problems.

THE MAN WITH THE GUN
NEEDS THE MAN WITH THE HOE

Farm Work is War Work
The First and Fundamental Sinew of War is FOOD
Without it, the Man with the Gun is Helpless
Without it, the Man Who Makes the Gun is Useless
Without it, Every Human Effort Ceases

All Honor to the Man with the Gun!
All Honor to the Man Who Makes the Gun!

All Honor, as well, to the man—too often overlooked—who so largely helps make possible the manufacture and use of the gun—the FARM WORKER in New England and the whole country, for his tremendous contribution to a vital and fundamental war effort! Without his work our very existence would cease!

★

NEW HAMPSHIRE GAS & ELECTRIC CO.
PORTSMOUTH, N. H.

With the health and welfare of its employees, its customers and the community depending in large part upon sustained agricultural production, this Company is vitally interested in the New England farmer and his wartime problems.

and gardening within their limits these times of food rationing. T advertising is broadly altruistic, though it is admittedly hoped th still more friendly public relatio will result from it along with creased popular consideration tillers of the soil as producers of t first and fundamental sinew of war *food.*

To Conserve Critical Materials this paper prescription was created:

Shortage of critical materials forced a manufacturer of vital war products to seek practical replacements for such materials. As many other manufacturers have done, this one discussed his problem with paper technicians of The Mills of Mosinee . . . and the above "prescription" was developed. The paper, made by Mosinee, is "serving the war effort" with complete satisfaction.

Whether your product demands high bursting-strength . . . dielectric, tear or tensile strength . . . pliability, controlled acidity or alkalinity . . . water repellency, accurate caliper, uniform density or other technical characteristics . . . discussions with Mosinee's engineers may disclose valuable opportunities for you in modern "Essential Papers."

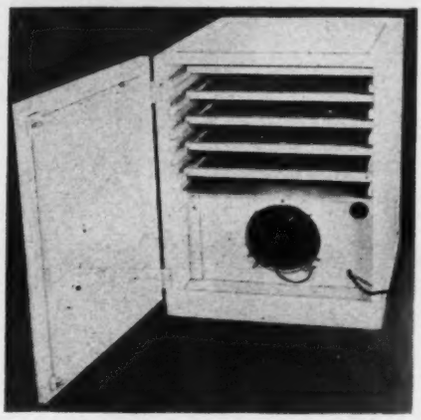
Please address your letter "Attention Dept. B"

MOSINEE PAPER MILLS COMPANY
MOSINEE • WISCONSIN
Essential Paper Makers

NEW EQUIPMENT

Dehydrator

Dehydrator designed for domestic use has a wood frame with masonite pressed wood sides and door. The unit has two nichrome wire heating elements with thermostat control and a heat-resistant fan for air circulation. One heating element of 125 watts is for constant operation, other element of 1,000 watts is for extra heat when needed. Apples, beets, swiss chard, spinach, etc., may be dehydrated.



Home dehydrator; capacity, ⅔ bushel of fruit or root vegetables or a bushel of greens; for 115-volt, 60-cycle circuits; dimensions, 24 in. wide, 27¾ in. deep, 30⅛ in. high. Traffic Appliance Division, Appliance and Merchandise Dept., **General Electric Co.**, Bridgeport, Conn.

•

Printer

Type "8Q" printer; rated widths 42 and 54 in.; speed ranges from 0.5 to 32 lineal feet per minute; one mercury vapor lamp; one blower motor; total 4.19 and 5.4 kw. on 220-volt, single-phase circuit. **Paragon-Revolute Corp.**, Rochester, 4, N. Y.

Designed for medium production requirements, new printer exposes blueprints, direct process prints and sepia negatives. It is equipped with a revolving 8-in. diameter Pyrex glass cylinder, tachometer, an exhaust fan, and a single-lever speed adjustment.

•

Bus Duct

Ventilated type feeder bus duct; available in WPB ratings of 800, 1,000, 1,350, 1,600 and 2,000 amp., single-phase, 3-phase, 3- and 4-wire, 600 volts or less. **Bulldog Electric Products Co.**, 7610 Jos. Campau Ave., Detroit, Mich.

Redesigned feeder bus duct has screened casing of expanded metal in place of solid metal casing formerly used. Ventilation afforded by the screen casing is said to assure low operating temperatures and increased current carrying capacities. Paired-phase busbar arrangement within the casing assures uniform current density through reduction of "skin effect" and "proximity effect," is the manufacturer's claim.

•

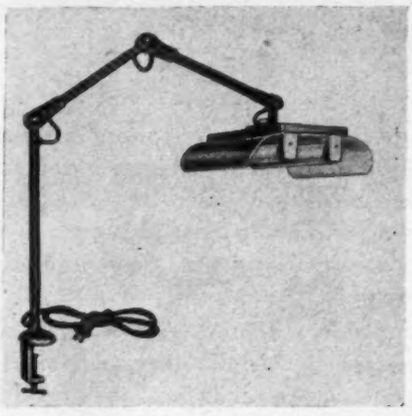
Insulation Tester

Model 610-B Meg-O-Meter; measures resistances from 0 to 200 megohms. **Superior Instruments Co.**, 227 Fulton St., New York, N. Y.

Self-contained, portable, direct-reading instrument (9½x8½x6 in.) can be used for both resistance measurements and insulation testing. Tests can be made at a potential of 500 volts d.c. supplied by a built-in battery and vibrator power supply. Scale is divided into three sections, "Bad" (0-1 megohm) printed in red; "Doubtful" (1 to 3 megohms); "Good" (3 to 200 megohms).

Lighting Unit

Useful for industrial operations where critical machining, inspection and assembly are performed, new fluorescent unit has flexible arm and is said to provide in excess of 100 foot-candles for the work area. Outside finish is wrinkle gray; inside reflector finish gloss white. A variety of arm lengths is available for positioning requirements.



"FLB" flexible arm fluorescent unit; accommodates two 14-watt fluorescent lamps; nonmetallic reflector is 15 1/16 in. long x 9 in. wide x 5⅝ in. high. **Fostoria Pressed Steel Corp.**, Fostoria, Ohio.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Water Level Indicator

New instrument, wall or panel mounted, shows level of water in boiler drum. Magnetic principle is said to permit complete separation of pressure parts from non-pressure parts without stuffing boxes. Balanced black pointer, attached to armature and revolving with it, registers changes in boiler water level on illuminated scale that shows green for normal operating range and red at high and low levels.

Remote water level indicator; two models; boiler pressures up to 1,500 psi. **Yarnall-Waring Co.**, Philadelphia, Pa.

Tubing

"Synflex FT-11" transparent, flexible tubing; range of working temperatures from —40 deg. F to +188.6 deg. F. **Industrial Synthetics Corp.**, Irvington, N. J.

New tubing, developed for extreme sub-zero applications, has dielectric strength of 1,000 v.p.m. Its transparency is said to facilitate circuit and wire code identification and permit immediate inspection of soldered points or connectors without removal of the insulating sleeve. Water absorption is 0.4 percent by weight after 24-hour immersion at 25 deg. C.

Magnets

Circular lifting magnets; sizes 20-65; average current at 230 volts, 2.3-58 amp.; weights, 450-8,900 lb. **Stearns Magnetic Mfg. Co.**, Milwaukee, Wis.

A series of circular lifting magnets supplements the company's line of magnetic separating equipment and magnetic transmission friction control devices. Features include renewable pole shoes of alloy steel, ribbed coil shield, unicoil construction, heat dissipation, leads and terminals protected against shock and damage, windings vacuum impregnated.

•

Coil Insulation

"No. 67" coil insulation with Insl-X toxicant; dielectric strength, 1,250 vpm. **Insl-X Co., Inc.**, 857 Meeker Ave., Brooklyn, N. Y.

Coil coating with toxicant is said to be particularly adaptable to tropical use. Coating dries at room temperature in 15 minutes and guards against attack by mildew, fungi and other organisms, it is claimed.

Significant of Things to Come

HUBBARD

On this spot may stand a transmission tower — a gun emplacement or new factory. It is the preliminary step to events of the future. It is symbolic of the state in which many of your suppliers find themselves at this time; going over the top on war production but with an eye cocked on the future.

Most of the men and machines of the three Hubbard factories have gone into vital war production, but the plumb bob is swinging, settling down to mark a spot for future development. New designs of Pole Line Hardware are coming. New equipment is being readied to test new principles.

Big things are "in the making". Watch for them, and in the meantime; "Maintain that load on Hubbard Hardware."

HUBBARD AND COMPANY

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1913 2043 ENTERING OUR SECOND CENTURY OF SERVICE

As Before-so After the War-

AMERICAN *De Luxe* BODIES

Will Be Preferred Equipment For Line Construction and Maintenance

● Today most of us are in the thick of it devoting all our resources pushing production to the limit to help "Uncle Sam" end this war as quickly as possible. And "American" is proud of the part it is privileged to take in the fight for Victory.

Because of this urgent need for war equipment, "American" engineers have had but little time to develop the **new models envisioned.**

So "American" line construction bodies for the period immediately following the peace will be the same in design as those built before the war. They will embody unchanged all the time-tested features of this super-quality equipment plus greatly improved construction. For the experience gained in building thousands of bodies for the severe off-the-highway service required by our armed forces in all parts of the world, enables "American" to assure you post-war line construction equipment that will last longer and require less maintenance than ever before.

Some Reasons Why "Americans" Are TOPS:—
Correct Design • Superior Quality Construction
• Comfort • Convenience
• Safety • Endurance
• Low Operating Cost
• Fine Appearance

As before the war so after, for top efficiency and economy you'll want "American" Equipment, and we'll be ready to make deliveries to you as fast as truck chassis are available.

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PUBLIC UTILITIES EQUIPMENT FOR MOTOR VEHICLES

TECHNICAL LITERATURE

REPORT—"A. C. Network Operations 1938-1940," a report of the transmission and distribution committee of Edison Electric Institute summarizes data submitted by 69 companies on operations of 253 networks in 145 localities. Copy of publication No. K-4 may be obtained from E.E.I. headquarters at 420 Lexington Ave., New York, N. Y.; price $1.50 to non-members in U. S. A.

SYMBOLS—Standardized electrical apparatus and device symbols for use in wiring diagrams are listed in the new "American Standard Graphical Symbols for Power, Control and Measurement," publication Z32.3-1943, available from American Standards Association, 29 West 39th St., New York, N. Y.; price 40 cents.

MOTORS—An outline and a chart on the selection of squirrel-cage motors relative to the frame design and torque and current characteristics are contained in a bulletin Form 344A, "Squirrel-Cage Induction Polyphase Motors," obtainable from Century Electric Co., 1806 Pine St., St. Louis, Mo.

ELECTRIC TOOLS—Special attention is given to common problems in connection with the maintenance of motor, cable, switch and brushes for portable electric tools; "Right" and "Wrong" operating methods are stated and illustrated; what to do when a tool fails to operate—are recovered in Booklet No. JE-199 "Maintenance Manual on Electric Tools," available from Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago, Ill.

INFRARED HEATING—Outlines and illustrations on how to conserve time, space, material, energy, and manpower, and sketches for infrared equipment installation are presented in a publication "Conserve for Victory With Near Infrared" issued by the Fostoria Pressed Steel Corp., Fostoria, Ohio.

"HOW TO TEACH FIRE FIGHTING" is an illustrated 16-page manual designed to aid factory executives in instructing employees in fire-extinguishing techniques. It describes the classification of various types of fires, the kind of extinguishers best suited to each and the methods of setting up demonstrations. The manual may be obtained from Walter Kidde & Co., Inc., 140 Cedar St., New York, 6, N. Y.

PRINT-MAKING—"Handbook of Print-Making and Processing" is available from Paragon-Revolute Corp., Rochester, 4, N. Y. This 40-page publication gives comparative advantages of various methods of print-making, of continuous yardage production as opposed to cut-sheet printing, and of the different types of processing equipment. Revolving contact principle of printing is discussed as well as the different types of lamps used for exposing the sensitized materials.

STAINLESS STEEL—Five 19x12½-in. charts list suggestions for systematic care of stainless steel equipment used in food handling and serving, food and beverage processing, dairy, process and chemical, and pulp and paper installations. An outline "How to Clean Enduro Stainless Steel Equipment" is included and lists cleansers and their reactions to stainless steel. Copies of each chart may be obtained from Republic Steel Corp., Cleveland, Ohio.

MAINTENANCE LITERATURE

A number of manufacturers have published useful booklets on the wartime maintenance of electrical and allied equipment. Many of these have been mentioned in ELECTRICAL WORLD's "Technical Literature" column. To make it easy to keep up to date, the editors present this bibliography of helpful and timely literature.

For your convenience, two business-reply cards are printed here for ordering literature. Fill one of the eight spaces for each piece of literature you order. This will assure your receiving the material promptly by reducing the amount of clerical work in handling your request. Please fill out each section of the coupon completely for each bulletin you wish. Coupons not filled out will not be handled.

BOILERS. Bulletin No. 16, "How to Safely Stretch Steaming Capacity," has been prepared for the use of steam power plant engineers to assist them in checking some of the many points which influence the economy, capacity and continuity of operation of steam power plants. Copies are available from the Bailey Meter Company, 1050 Ivanhoe Road, Cleveland, Ohio.

BOILERS. Reprints of the following technical papers contain useful information on maintenance and operation of steam boilers:
"Maximum Output from Existing Boiler Plants"—(3-306)
"So You Want a New Plant"—(3-309)
"What the Operator Wants to Know"—(3-313)
"War and How to Keep Boilers Steaming"—(3-326)
Copies may be secured from The Babcock and Wilcox Co., 85 Liberty St., New York, N. Y.

CABLE. The following literature on cable care and maintenance may be secured without cost:
"How to Get Extra Life and Efficiency from Electrical Wires and Cables."
"Take Good Care of Your Electrical Wires and Cables."
"War Emergency Methods as Applied to Power Cables."
Available from The Okonite Company, Passaic, N. J.

CENTRIFUGAL PUMPS. "Handbook for Wartime Care of Centrifugal Pumps." This handbook explains the anatomy of a centrifugal pump, what each part does, how it does it and how it should be cared for. Available from Allis-Chalmers Mfg. Co., Milwaukee, Wisconsin.

CONDENSER TUBES. To keep condenser and heat exchanger tubes in service under wartime conditions, a complete "Condenser Tube Booklet" is available with diagrams, formulæ and authoritative discussions of types of corrosion, selection of alloys and solutions of special maintenance problems. Write to Scovill Manufacturing Company, 13 Mill St., Waterbury, Conn.

CONTROL EQUIPMENT. A booklet entitled "How to Make Your Pressure Gauges, Thermometers, Control Instruments, Safety, Relief and Globe Valves Last Longer" is available, upon request, from Manning, Maxwell and Moore, Inc., Bridgeport, Conn.

CONTROL EQUIPMENT. An 8-page bulletin entitled "Maintenance Guide on Industrial Control" offers suggestions to help maintenance men get the best performance from industrial control equipment. Also included are tables of tips for speedy trouble shooting. Available from the General Electric Company, 1 River Road, Schenectady, N. Y.

8 FIRE EXTINGUISHERS. Suggestions for lengthening the service life of portable fire extinguishers are contained in the folder "Directions for Inspecting, Recharging and Maintaining Portable Fire Extinguishers." Available from Pyrene Manufacturing Company, 560 Belmont Avenue, Newark, N. J.

9 FUSES. A handbook on fuses, "Fuseology," discusses history and general con-

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struction of fuses, tips on use and maintenance. Available from Bussman Mfg. Co., St. Louis, Mo.

10 GENERATORS, D. C. Instruction Book No. 502, entitled "Instructions for the Installation, Care and Operation of Direct-Current Generators," contains valuable data on the installation and preparation of direct current generators for service, operation of 2-wire generators, parallel operation, maintenance, repairs and instructions for 3-wire generators. Available from Crocker-Wheeler Electric Mfg. Co., Ampere, N. J.

11 LIGHTING MAINTENANCE. A 20-page booklet, "Timely Wartime Tips on Fluorescent Maintenance" is designed to help prevent fluorescent trouble before it starts. It shows how to maintain and conserve fluorescent equipment and how to obtain efficient and economical operation. Available from Sylvania Electric Products Co., Inc., Salem, Mass.

12 LIGHTING MAINTENANCE. The booklet, "How to Get More Light for Your Money" contains information regarding maintenance of home lighting equipment. Available from Westinghouse Electric and Mfg. Co., East Pittsburgh, Pa.

13 LIGHTING MAINTENANCE. How to make the most of electric lamps and lighting is the purpose of a 24-page maintenance manual. Information is presented for men responsible for the maintenance and efficiency of incandescent and fluorescent lighting systems. Available from Champion Lamp Works, Lynn, Mass.

14 LIGHTING MAINTENANCE. A guidebook entitled "Fluorescent-Service and Maintenance Handbook" explains how to take care of a fluorescent lighting system and sets forth simple principles that can easily be applied to the care of a installation. Available from Westinghou Electric & Mfg. Co., 306 Fourth Ave., Pi burgh, Pa.

15 LIGHTING MAINTENANCE. Bu tin LM-15 describes "Lighting Maintena in War Industry Plants." Outlines pr tical methods of increasing average li output through an economical maintena program. Available from Lamp Dept., G eral Electric Company, Nela Park, Cle land, Ohio.

16 MAINTENANCE. "Preventive Ma tenance—Wiring System Survey." This page booklet outlines a plan to preve electrical service shutdowns. The "Preve tive Maintenance" Plan is a practic working program designed by a group men actively concerned with the main nance of industrial plant electrical syste Copies may be secured from Anacon Wire and Cable Company, 25 Broadw New York.

17 MOTORS. 3 valuable booklets motor maintenance outline complete pr grams of assuring longer motor life. Th titles are:

"How to Select and Maintain Sin Phase Motors"

"How to Maintain D. C. Motors"

"How to Care for Motors"

Copies may be secured by writing to Ge eral Electric Company, 1 River Road, Sch nectady, N. Y.

18 MOTORS, INDUCTION. Instructi Book No. 501 contains 12 pages of va able suggestions for the installation, ca and operation of Induction Motors. Pa ticular attention is paid to lubrication bearings, cleaning, operating troubles a tips on maintenance. Available fr Crocker-Wheeler Electric Mfg. Co., A pere, N. J.

19 MOTORS. Bulletin No. 518-A, "S lection and Maintenance of Electr Motors," lists the precautions and pra tices to be taken to assure dependab trouble-free performance of an electr motor. Available from the Louis Allis C Milwaukee, Wisconsin.

20 MOTORS. "A Guide to Wartim Care of Electric Motors." This handbo explains the principles of electric mot care, outlines the natural "enemies" of a electric motor and describes how to co bat them. Available from Allis-Chalme Mfg. Co., Milwaukee, Wisconsin.

21 "101 Suggested Good Operating Pra tices for Using Packings, Insulations, Roo ings, Friction Materials and Refracto Cements" is the title of a wartime maint nance bulletin available from Johns-Ma ville, 22 East 40th St., New York, N. Y.

22 PROTECTIVE PAINTS. Comple information in booklet form is available o anti-corrosive paints for electric light an power maintenance and construction, an on paints for camouflaging structures an equipment. Literature for the latter co tains sample swatches of colors availabl Write to Subox, Inc., 348 River Roa North Arlington, N. J.

23 PIPING SYSTEMS. "Piping Poin ers," a series of maintenance bulletin helps train new maintenance men to kee piping systems working. Useful as te material in employee training classes f for brushing up on wartime piping pra

(*Continued on page* 118)

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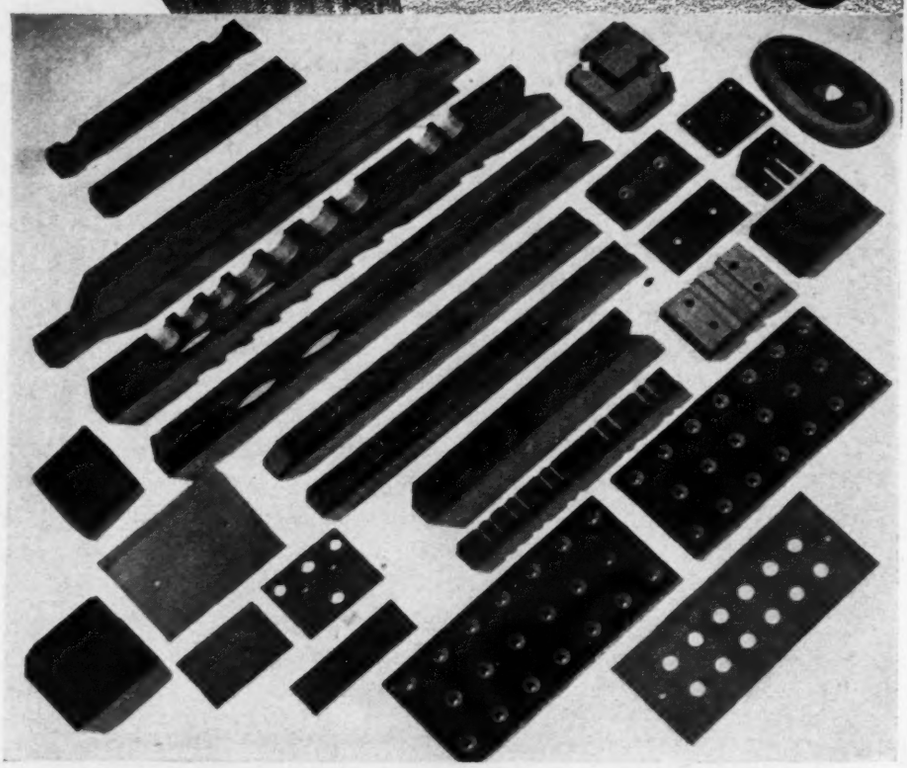
LENGTHENING SHADOWS OF PROGRESS

PHOTOS COURTESY PAN AMERICAN AIRWAYS

oday the Flying Clippers of Pan merican Airways cast their adows on the four corners of e earth, symbolically repre- enting the lengthened shadows ast by the modest FOKKER F7, rst used by Pan American in 927 over the single route be- ween Key West and Havana . . . hey are the ever-lengthening hadows of progress.

With constant improvement, re- earch and close collaboration ith aviation design engineers, -D Plastics are likewise casting n ever-lengthening shadow of ure progress in the field of viation. Without question C-D lastics have played an import- nt role among the many ma- erial advancements that have ade possible today's flying iants. This progress has resulted n better plastics with greater mechanical, electrical and struc- ural properties.

llustrated are just a few of liter- lly hundreds of parts now fab- icated from DILECTO laminated phenolic plastics for use in mod- ern airplanes. The knowledge and experience gained in de- signing these parts for aircraft applications are available to you . . . Use them to solve your "what material?" problem.



C-D products include THE PLASTICS . . . DILECTO—a laminated phenolic: CELORON—a molded phenolic: DILECTENE—a pure resin plastic especially suited to U-H-F insulation . . . THE NON-METALLICS, DIAMOND Vulcanized Fibre: VULCOID—resin impregnated vulcanized fibre: and MICABOND—built-up mica insulation. Folder GF describes all these products and gives standard sizes and specifications.

DISTRICT OFFICES: New York - Cleveland - Chicago - Spartanburg, S. C.
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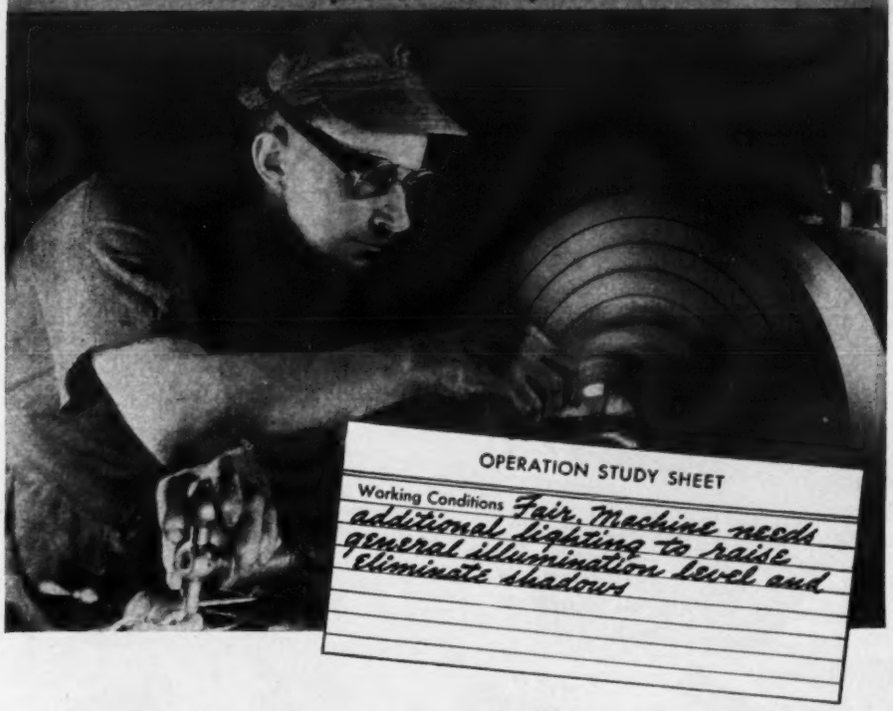
Continental-Diamond FIBRE COMPANY

Established 1895 . . Manufacturers of Laminated Plastics since 1911 — NEWARK • DELAWARE

RE-LIGHTING

the new manpower production *requirement*


OPERATION STUDY SHEET
Working Conditions Fair. Machine needs additional lighting to raise general illumination level and eliminate shadows

This man needs more light

The plant where this worker is employed—like most plants built before Pearl Harbor—was probably designed for peacetime production, with lighting equipment intended merely to supplement daylight. Hence, *its lighting system is inadequate for wartime night work*—and production falls off seriously on the "swing shifts."

Re-lighting for better illumination will correct this condition, make it easier for workers to see—thus increasing efficiency and production. Re-lighting costs little and is easy to arrange. A Silv-A-King lighting engineer, for instance, can tell you quickly how to re-locate lamps to eliminate glare and shadow...show you where it is necessary to increase lamp wattages or install additional equipment to insure uniform high lighting levels.

Silv-A-King fluorescent equipment, with reflectors of non-critical Silv-A-Tex, is available for prompt delivery to war plants. Silv-A-King equipment (fluorescent or incandescent), plus a Silv-A-King "engineered layout" make an unbeatable combination.

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Send for new Folder 43-V describing Silv-A-King "Victory" Fluorescent Units.

FLUORESCENT
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SILV-A-KING MAKES *Light* WORK FOR YOU

tices. Available from Crane Co., 836 Michigan Ave., Chicago, Ill.

24 POLES. Information useful in increasing standing pole life and reducing costly pole replacement is contained in a folder describing groundline treatment. Ask for the folder "Osmoplastic Groundline Treatment for Standing Poles." Available from Osmose Wood Preserving Company of America, Inc., 1437 Bailey Ave., Buffalo, N. Y.

25 RUBBER V-BELTS. "Plain Facts on Wartime Care of Rubber V-Belts." How to raise V-belts care to wartime standards of efficiency and how to make V-belts last longer is the subject of this handbook. Available from Allis-Chalmers Manufacturing Co., Texrope Division, Milwaukee, Wisconsin.

26 SAFETY EQUIPMENT. A 32-page booklet, "How to Make Your Safety Equipment Last Longer," offers valuable suggestions for extending the life of safety equipment such as hats, gas masks, sterilization equipment, hose masks, respirators, inhalators and oxygen breathing apparatus, goggles, face masks, safety clothing and first-aid kits. Available from Mine Safety Appliance Company, Pittsburgh, Pa.

27 STORAGE BATTERIES. A complete manual of service and technical information on Edison Batteries discusses battery care and maintenance tips on installation and presents useful test data. Available from Thomas A. Edison, Inc., Emark Battery Division, Kearny, New Jersey.

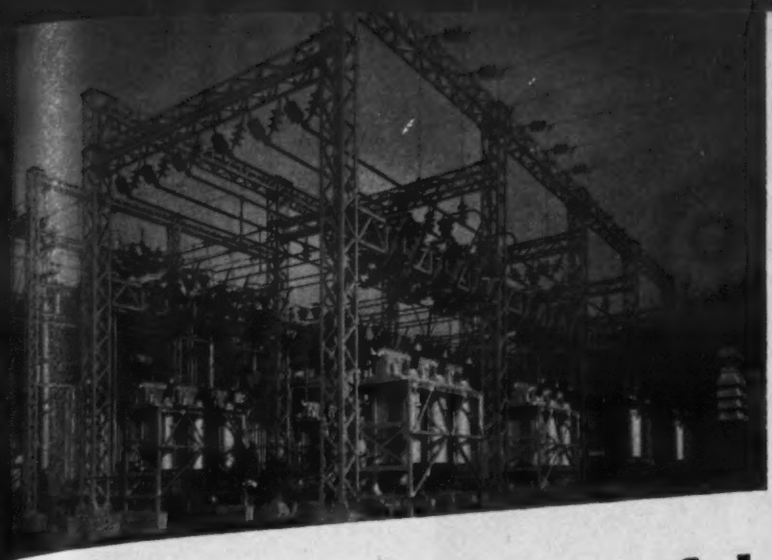
28 STORAGE BATTERIES. A 24-page booklet entitled "The Storage Battery—Its Fundamentals, Use and Maintenance" explains how to secure maximum life from storage batteries. Available from the Electric Storage Battery Co., Allegheny Ave. and 19th St., Philadelphia, Pa.

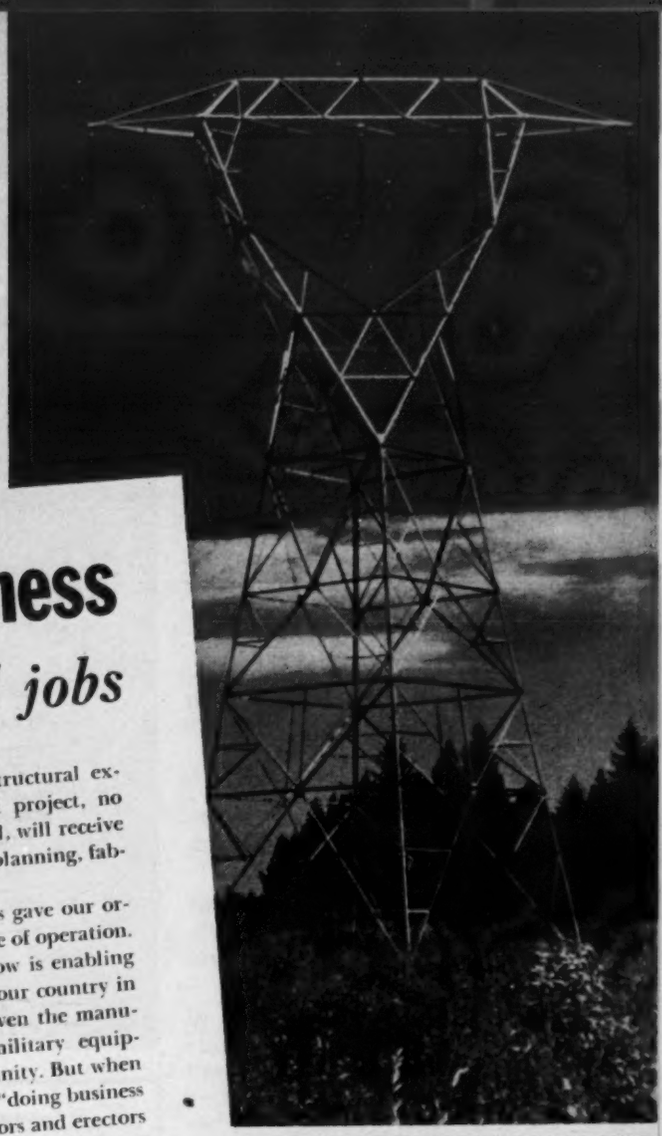
29 STOKERS. The booklet "Fundamentals of Stoker Operation and Maintenance" contains information on all present-day types of stokers: single retort underfeed, multiple retort underfeed, chain and traveling grate, and spreader. A technical paper entitled "Some Ways to Avoid High Stoker Maintenance" is also included. Available from Combustion Engineering Co., Inc., 200 Madison Ave., New York City.

30 LINE CONSTRUCTION AND MAINTENANCE TOOLS. A new 32-page booklet, "Wartime Care of Line Construction and Maintenance Tools," is now available from Graybar Electric Company, Inc., 420 Lexington Ave., New York, N. Y. Discusses care of hand tools and mechanical line construction and maintenance tools, splicing and soldering tools, live line tools, underground tools and specialties. Booklet GB 5017.

31 TOOLS. A 48-page booklet on the Porter Bolt Clipper shows users how to get the best results and longest possible service with these tools for the duration—and after. Tips on adjustments, maintenance and repair are accompanied by a profusion of graphic illustrations. Available from H. K. Porter, Inc., Everett, Mass.

32 TOOLS. A folder entitled "Tool Notes" contains valuable maintenance and repair suggestions to prolong life of Crescent Tools. Tips on the care and use of wrenches, screwdrivers, hacksaws, pliers, chisels, punches, snips and nailpullers are





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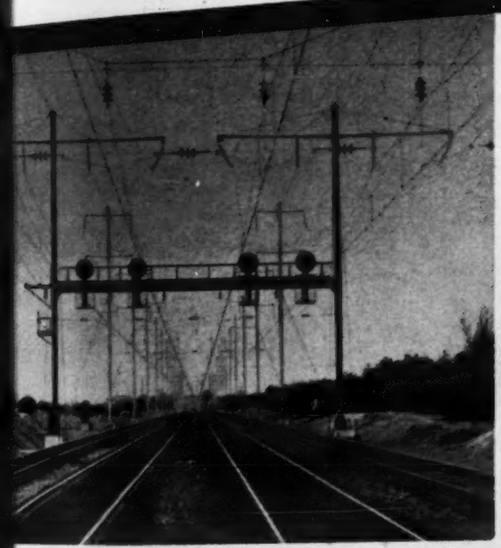
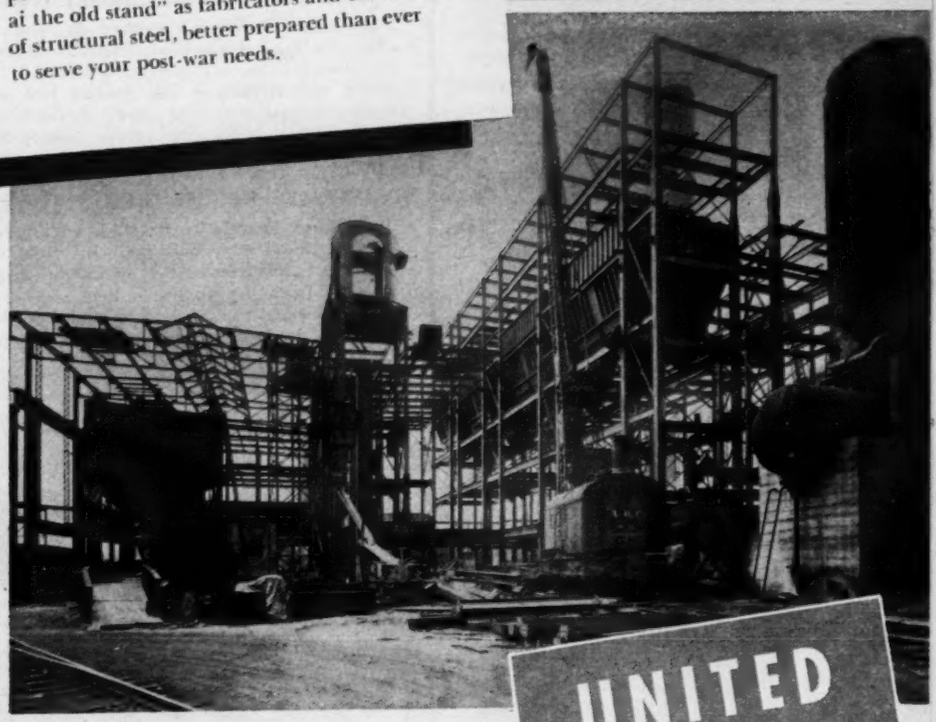
—a "plus" for your structural jobs

DURING the many years we have fabricated and erected steel structures for the electric power industry, one characteristic of American Bridge service has had more to do with the success of the jobs we have handled than anything else. It isn't a tangible factor. We can't write it into contracts. But every project benefits from it. You may have heard it called *engineering resourcefulness.*

What is this quality worth to you? . . . It means that every job American Bridge undertakes—whether it is the steelwork for a generating station, the towers for a transmission line, a substation structure, or an electrification project—will profit from an unsurpassed background of structural experience. It means that each project, no matter how large or how small, will receive the same painstaking care in planning, fabrication and construction.

Engineering resourcefulness gave our organization its worldwide scope of operation. This same resourcefulness now is enabling us to serve the war needs of our country in numerous ways, including even the manufacture of high-precision military equipment. We value this opportunity. But when peace returns, you'll find us "doing business at the old stand" as fabricators and erectors of structural steel, better prepared than ever to serve your post-war needs.





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USS UNITED STATES STEEL

MORE CABLE PROTECTION AT LESS COST

When you choose conduit for housing cable, *complete* protection should be your first and foremost consideration. This is especially true today. Continuous, uninterrupted supply of power, light, telephone, and signal service is so vital to America's war plants, power plants, shipyards, airports, cantonments, and naval bases.

Orangeburg Fibre Conduit offers you *maximum protection at lowest cost.*

Check These Features!

① Long cable pulls are easier with Orangeburg, which means less strain on cable.

② Orangeburg does not abrade or score cable sheath, even with long pulls around bends.

③ The organic nature of Orangeburg material inhibits alkaline corrosion of lead sheath along lines of contact —and also protects rubber and synthetic sheath.

④ The taper sleeve joint and impermeable pipe prevent infiltration of corrosive ground alkalies or acids in the duct line.

⑤ Light in weight — Orangeburg assembles and installs faster.

⑥ Non-metallic, non-cementitious — Orangeburg conserves critical materials.

Write for catalog today!

ORANGEBURG STANDARD CONDUIT (Type I)

Orangeburg Standard, encased in concrete, offers the most economical construction where banks of four or more ducts are involved. For nearly half a century, this conduit has been serving utilities, industrial plants, railroads, and municipalities—protecting cables underground with this type of construction.

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Orangeburg Nocrete is installed underground without concrete encasement. It offers real economy in the construction of single, double or triple runs. Its ability to take severe soil stresses without rupture and to maintain cross-section under heavy loads, makes it ideal for this type of construction.

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included. Available from Crescent T Company, Jamestown, N. Y.

33 HOT-LINE TOOLS: A 92-page boo let (Bulletin 331) devotes considera space to examples of how Kearney Hi-L tools make live-line maintenance e nomical. Tips on how to handle typic pole-line installations are included. Ava able from James R. Kearney Corp., 42 Clayton Ave., St. Louis, Missouri.

34 TOOLS. A 24-page booklet "Lo Life to Tools" discusses proper care tools and offers suggestions for their sa use. It contains information useful to lin men, electricians and mechanics on plie leather belts and straps, climbers, wi grips, rope, wrenches, screw drivers, pik poles, shovels, axes, chisels and files. Ava able from Mathias Klein and Sons, 32 Belmont Ave., Chicago, Ill.

35 TRANSMITTING TUBES. Bookl IF 8014 presents "Tips on Making Tran mitting Tubes Last Longer." Explains ho to double the life of tungsten-filament tub and how to lengthen the life of mercur vapor rectifier tubes. Available from RC Victor Division of Radio Corporation America, Harrison, N. J.

36 TRANSMITTING TUBES. Bookl GEA-3927 describes "How to Make Yo Transmitting Tubes Last Longer." Ex plains how to remove causes of premature tube failure, how to get longer life fro mercury-vapor and thoriated-tungsten-fil ment tubes. Available from Radio, Tel vision and Electronics Dept., General Ele tric Co., Schenectady, N. Y.

37 VALVES, OIL-RELIEF. Instructio for the care and repair of oil relief valv are presented in a handy 32-page bookle Particular attention is paid to adjustmen disassembly for repair, lapping and grin ing, and reassembly. Available from Ma ning, Maxwell and Moore, Inc., Bridgepor Conn.

38 WATTHOUR METERS. Suggestio for changing single-phase meter ratings t suit present-day requirements are contain in the booklet "Wartime Utilization of Ex isting Watthour Meters." Available fro Westinghouse Electric & Mfg. Co., Mete Division, Newark, N. J.

39 ARC-WELDERS. "How to Maintai Arc Welders" is the title of a bulleti which contains suggestions for assurin maximum operating efficiency and low up keep cost of arc-welding equipment. Avai able from General Electric Company, River Road, Schenectady, N. Y.

•

G. E. Speeds Turbine Production Program

General Electric Co. will produc more than 11,000,000 hp. rating o steam-turbine propulsion equipmen this year for ships of the Navy and th Maritime Commission, E. O. Shreve vice-president, has revealed.

"This is seven and one-third time greater than the company's production of turbines in 1941," he commented Production in 1944 will be nine time as great, he added, representing an in crease of 900 percent over 1941.

When the Conventional is Upset, *Call in Experience*

There's nothing like the stratosphere to upset the conventional—as was proved by conventional contact material in a 200 ampere relay for military aircraft.

In the factory, on the ground, the relays functioned perfectly; in the air, six miles overhead, the contacts stuck . . .

The cause? The remedy? And no time to lose! The relay manufacturer remembered Mallory experience and contact "know how"—and laid the problem in our lap for a solution "instanter".

The right answer lay in two Elkonite* alloys, operating against each other. It did not take Mallory engineers long to find the combination . . . develop a Mallory contact assembly . . . it was unconventional, but it passed all tests . . . stood up on loads considerably over the 800 ampere overload tests . . . gave considerably longer life without sticking or welding. No appreciable difference in operation appeared between sea level and stratosphere temperature.

Score one for cooperation based on contact knowledge. Check it off as part of the day's work for Mallory contact men. They, too, are eager to speed victory production and they are hunting trouble—with contacts and complete contact assemblies—because here is one place where they always can help.

While the design is still in blueprint form

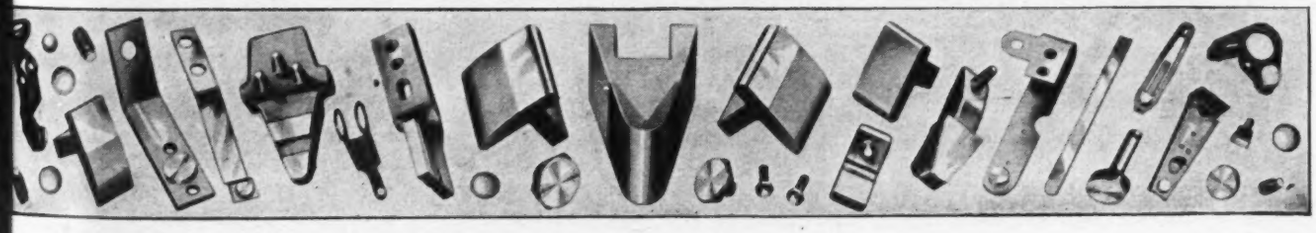
CONSULT MALLORY
for Contacts and Contact Assemblies

P. R. MALLORY & CO., Inc., INDIANAPOLIS, INDIANA
Cable Address—PELMALLO

*Reg. U. S. Pat. Off.

P. R. MALLORY & CO. Inc.
MALLORY

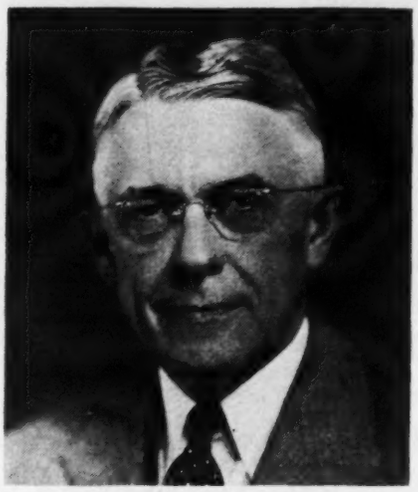
ELECTRICAL CONTACTS AND CONTACT ASSEMBLIES
NON FERROUS ALLOYS, POWDERED METAL ALLOYS



NEWS ABOUT PEOPLE

G. A. Freeman Retires at Commonwealth Edison

Gaylord A. Freeman, vice-president in charge of sales for Commonwealth Edison Co., will retire August 1, after 42 years of service. Succeeding him will be William T. Reace, his assistant,



G. A. Freeman

W. T. Reace

who was elected to the vice-presidency at a meeting of the board of directors late last week.

Entering the company in 1901 in a clerical capacity, Mr. Freeman rose to the rank of chief clerk in 1909. Six years later he was made executive in charge of a subsidiary concern engaged in the manufacture of electric storage-battery-driven vehicles.

Returning to the parent company in 1933, Mr. Freeman pioneered its promotional work in air conditioning. From 1935 to 1937 he served as manager of industrial relation. He returned to sales activities as assistant to the vice-president three years ago.

Mr. Reace started his Commonwealth Edison career in 1916 as a sign salesman. He subsequently served in several other sales capacities and was appointed supervisor of refrigeration sales in 1928. He was named assistant manager of merchandise sales in 1936, manager in 1938 and assistant to vice-president last year.

•

W. J. Russell Joins Staff Landers, Frary & Clark

William J. Russell, formerly manager of engineering of the Westinghouse electric appliance division at Mansfield, Ohio, has been appointed vice-president of Landers, Frary & Clark, New Britain, Conn., in charge of engineering. L. A. Brown, for more than 21 years associated with the organization, has been appointed to the position of vice-president in charge of manufacturing and works manager for all the company's plants.

A native of Edinburgh, Scotland, Mr. Russell came to the United States in 1920. In 1924 he entered the employ of the Westinghouse Electric & Manufacturing Co. at the Springfield, Mass., works. After 3½ years as tool and die maker he was transferred to the rate department, and subsequently was made development engineer for the manufacturing, engineering and cost reduction department. In 1932 he was transferred to Mansfield and two years later was promoted to the position of manager of engineering.

Mr. Russell is a member of the American Institute of Electrical Engineers and is active in many technical groups of the National Electrical Manufacturers Association. He received the Westinghouse order of merit this year in recognition of "his vision and engineering ability in the field of home appliances. . . ."

W. J. Russell

•

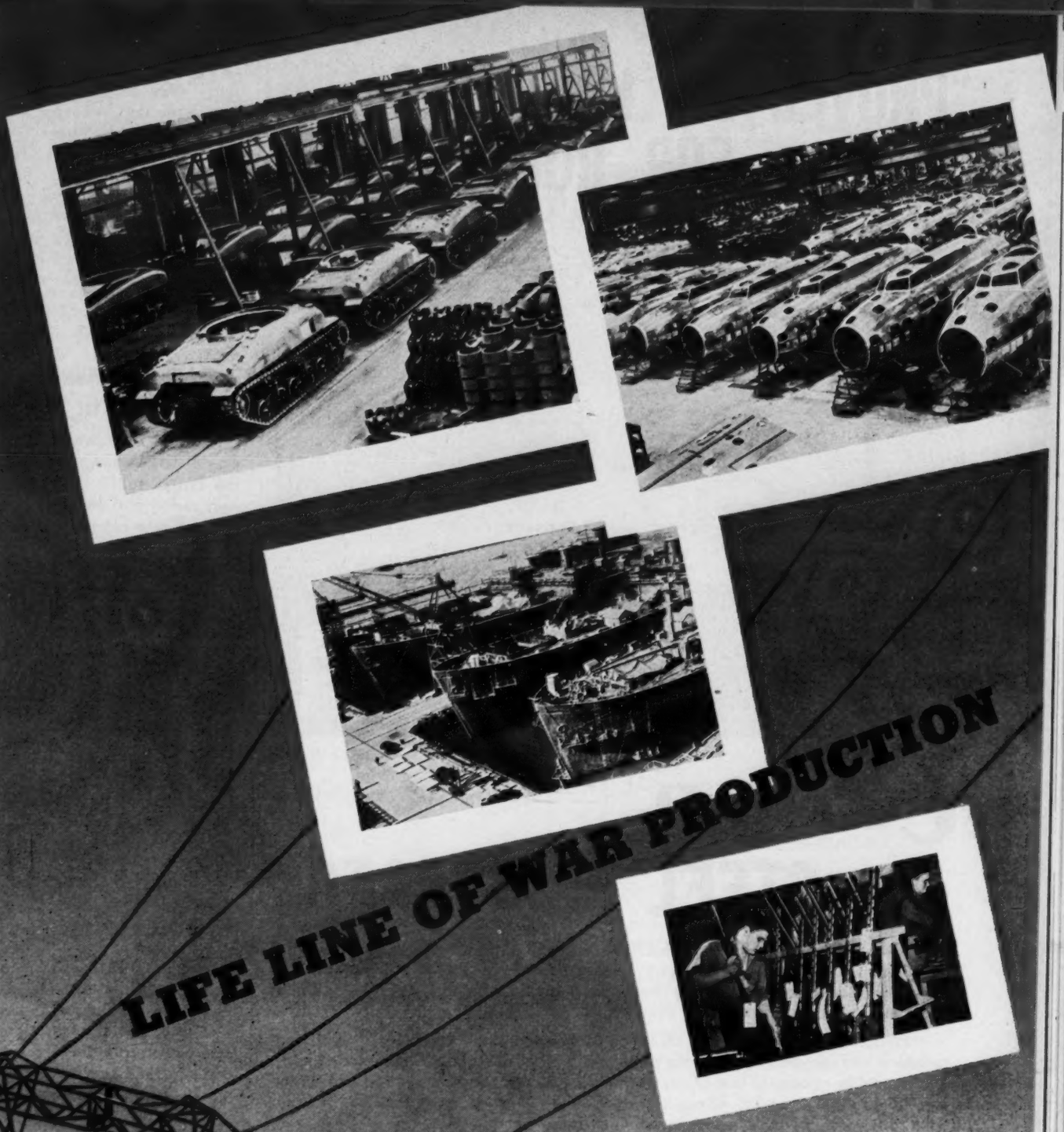
N. Y. Power & Light Names McEvoy Vice-President

Frank T. McEvoy, resident manager of the Albany district of the New York Power & Light Corp. since 1938, has been elected a vice-president of that utility. Mr. McEvoy began his career with the company in 1928 and was made purchasing agent in 1930. His assignment followed eight years later.

Storrs M. Bishop succeeds Mr. McEvoy as resident manager of the Albany district. He had been resident manager of the Hudson district since 1937. He started with the company in Schenectady in 1926 and was made resident manager at Port Henry in 1930.

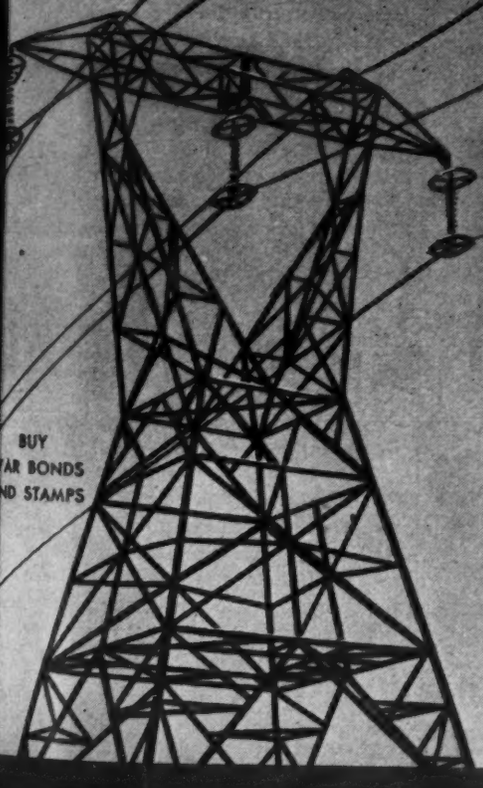
O. B. Nye has been transferred to Hudson as resident manager, after hav-

F. T. McEvoy



LIFE LINE OF WAR PRODUCTION

Through transmission lines flows the current that makes American war production possible. Supporting these Arteries of Victory are Blaw-Knox Transmission Towers . . . proved by their performance to be engineered right, built right for long-lasting, low-maintenance service.



BUY
AR BONDS
ND STAMPS

BLAW-KNOX
TRANSMISSION TOWERS

Blaw-Knox Division of Blaw-Knox Company
Farmers Bank Building, Pittsburgh, Pa.
New York • Chicago • Philadelphia • Birmingham • Washington

"PROVED IN" LONG AGO FOR RURAL LINES

IN SERVICE SINCE 1936

Crapo Steel Conductor in rural primary distribution line. Location: Texas. Average span length, 600 feet.

Crapo STEEL CONDUCTOR

The operating efficiency of *Crapo* Steel Conductors was established long before the present emergency. Thousands of miles of these high-tensile, low-resistance steel conductors have been giving efficient, reliable and economical service on rural lines since 1936.

Crapo Steel Conductors afford an unique combination of electrical characteristics and physical properties never before attained in a ferrous conductor. They provide relatively low 60-cycle resistance, low magnetic permeability and low 60-cycle reactance. Their high-tensile strength permits the use of long-span, low-cost construction; saves man-hours and material; reduces maintenance problems.

Crapo Steel Conductors can be handled and "pulled in" with the same facility as any other conductor. For rural extensions authorized by Utilities Order U-1-c, specify *Crapo* HTC-130 in No. 6 B.W.G. Stranded (3-wire) — the type recommended for this purpose. Ask the representatives of the Graybar Electric Company Inc., Distributors, or contact the nearest Graybar office!

WRITE FOR NEW ENGINEERING MANUAL containing complete technical information on *Crapo* Steel Conductors, including electrical characteristics and performance, sag and tension data and applicable construction practices! Address:

INDIANA STEEL & WIRE COMPANY
MUNCIE, - - INDIANA

Crapo HTC-130 STEEL CONDUCTORS

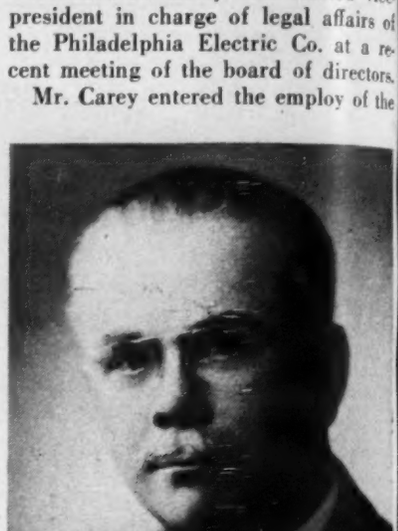
ing served as resident manager at Port Henry since 1936. Mr. Nye began his work with the company in 1930 and has served in the street lighting and power sales departments. He has been succeeded at Port Henry by Patrick J. Sullivan, sales promotion supervisor at Hudson since 1939. Mr. Sullivan began work with the company at Chestertown in 1925 and has served in the line, engineering and rural service departments.

•

B. P. Carey Assumes New Duties in Philadelphia

Bernard P. Carey was elected vice-president in charge of legal affairs of the Philadelphia Electric Co. at a recent meeting of the board of directors.

Mr. Carey entered the employ of the



company in 1913. Five years later he was transferred to the legal department as a law clerk and assistant to the vice-president, the late Arthur B. Huey. He was attorney for the company from 1924 to 1928 and its counsel from 1928 to 1939, when he was made general counsel, the position he held immediately prior to his selection as vice-president.

Mr. Carey is a past-president of the Pennsylvania Electric Association and a member of the American Bar Association and the American Gas Association.

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► H. W. KING, formerly assistant engineer, Consolidated Edison Co. of New York, Inc., is now with the Anaconda Wire & Cable Co., Hastings, N. Y.

► T. E. ROACH, vice-president of the Northwestern Electric Co., Portland, Ore., has been appointed chairman of the Portland committee for economic development. The committee is headed nationally by Paul G. Hoffman, presi-

ent of the Studebaker Co., and is ledged to town-by-town, company-by-ompany post-war planning.

•

Star Electric Motor Co. Names New Executives

Appointment of a new executive staff f the Star Electric Motor Co. and its ffiliate, the Star Equipment Corp., has een recently announced. The realignent was brought about both by the eath of Carl M. Peterson, co-founder, ho served as secretary and treasurer f both organizations, and as a result f the companies' expansion. Since the rganization of the motor company in 910, he and Emil E. Hollander, presient, had been the only officers.

Under the new set-up Elvin E. Hallander was made first vice-president of oth companies, Ivor C. Peterson vicepresident in charge of sales and R. J. ash secretary and treasurer. Raymond . Hollander becomes vice-president in harge of planning and purchasing for he motor company. while Fred Eberard becomes vice-president and genral manager of the equipment corporaion. Elvin E. Hallander, in addition o his title as first vice-president, is eneral manager of the motor company.

•

▸ CARL L. HOFFMAN, supervisor of ommercial sales for the Washington Water Power Co., has been elected presdent of the Spokane Advertising and ales Association.

▸ HENRY C. TILLMAN was elected chairman and GEORGE P. RANEY vice-chairman of the Tampa (Fla.) utility board t a recent reorganization meeting. J. G. EDINGFIELD was seated as a new member to succeed C. C. WATSON, chairman, hose term expired, but who was lected secretary.

▸ HERBERT G. DILLON has been appointed manager of the newly formed ining section of the industrial department of the Westinghouse Electric Manufacturing Co. A native of Woodward, Okla., Mr. Dillon joined Westnghouse in 1923 shortly after his gradation from Oklahoma A. & M. From 933 to 1941 he was sales engineer with he General Motors Corp. He then beame identified with the Lee Norse Co., erving as sales manager until his rent assignment with Westinghouse.

▸ FRED BERG, assistant superintendent f the Puget Sound Power & Light Co. t Kelso, has been appointed manager succeed Byron M. Atkins, retired. Mr. Berg has been identified with uget Sound Power & Light at Kelso

"WAR-AID"

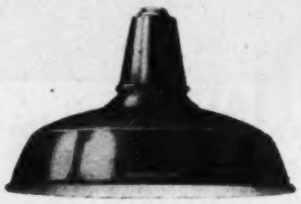
Fluorescent Fixtures *by Wheeler . . .*

Sturdy metal-conserving wiring channel. Non-metallic reflector with chip-proof washable surfaces. Made for 2 or 3 40-watt lamps, or 2 100-watt lamps. Easily adapted for continuous runs.

• maintain "skilled lighting" standards

• conserve critical materials

OTHER WHEELER FIXTURES



RLM One-Piece Solid Neck Reflectors

Made in Dome, Angle and all other standard types. For indoor or outdoor use.

Class II-G Dust-Tight Units

Fluorescent fixtures approved for "Class II-G" hazardous locations. Hinged cover protects lamps, sockets and reflecting surfaces. Made for two or three 40-watt lamps.

IT takes accurate "seeing" by workers to maintain today's precision standards of production. In any warplant, that means lighting of the most modern, efficient type.

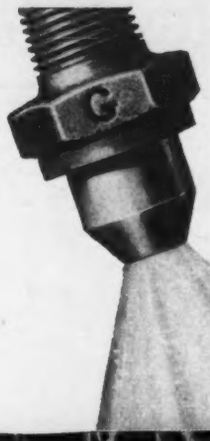
To make such lighting available *in spite of wartime metal shortages*, Wheeler Reflector Company developed "War-Aid" RLM Fluorescent Fixtures. Made with minimum strategic materials . . . designed with "know how" gained in over 60 years of specialized experience . . . "War-Aid" Fixtures offer the same high-efficiency illumination that has always typified Wheeler "Skilled Lighting."

Whether you require fluorescent or incandescent illumination, Wheeler can supply *skilled lighting* for precision production. Write for catalogs of both types. **Wheeler Reflector Co., 275 Congress St., Boston, Mass.** . . . New York, Cleveland. Representatives in principal cities.

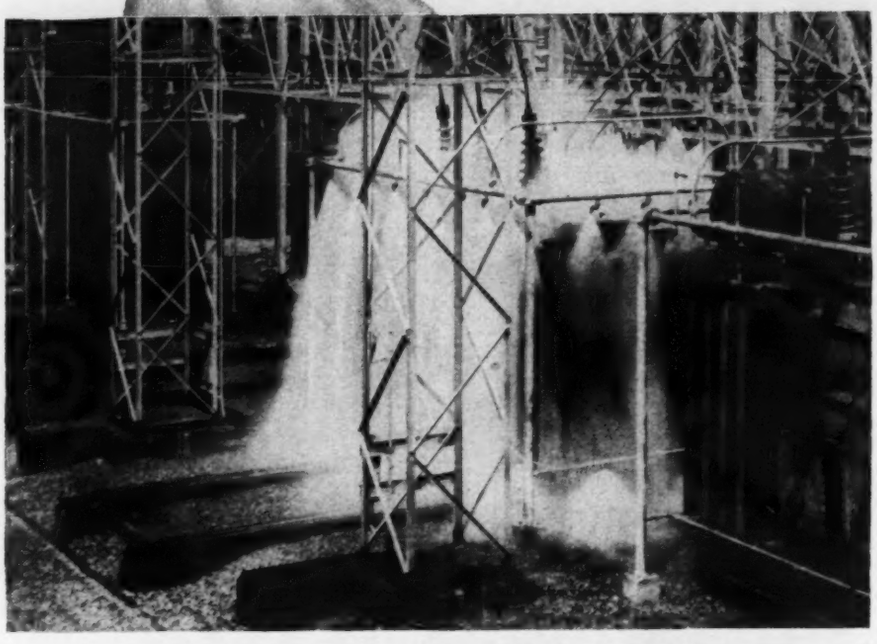
Distributed Exclusively Through Electrical Wholesalers

Wheeler REFLECTOR COMPANY

Lighting Equipment Specialists Since 1881



How to prevent
"ABSENTEEISM"
of Power-Producing Equipment



Protect your oil-filled equipment from FIRE with a GRINNELL MULSIFYRE SYSTEM

MULSIFYRE SYSTEMS operate on the principle of mulsifying blazing oil with a driving spray of water. The oil is turned into a liquid which is incapable of burning. A Mulsifyre System extinguishes fire in a few seconds and prevents reignition.

Complete separation of water and oil takes place in a few hours . . . leaves oil undamaged.

There is absolutely no conductivity along the discharge of a Mulsifyre projector when spray strikes conductors carrying high voltages.

Mulsifyre Systems are permanently installed . . . they operate automatically and manually.

Recommended by Underwriters' Laboratories for use in extinguishing fires in flammable oils immiscible with water, wherever such oil is a fire hazard . . . in transformers and other oil-filled electrical equipment.

Investigate this simple, sure oil fire protection. Write for Data Book by Underwriters' Laboratories. Grinnell Company, Inc., Executive Offices, Providence, Rhode Island. Branch offices in principal cities of U. S. and Canada.

GRINNELL
MULSIFYRE SYSTEMS

For Production Protection

since 1925. Mr. Atkins retired af 46 years in the light and power fie Thirty-two of these years he was locat in Kelso.

•

General Electric Makes New Appointment

J. C. Mahoney, superintendent of t turbine and marine installations secti of General Electric Co.'s service eng neering division since 1922, has retire He is succeeded by T. W. Howard, wh has been his assistant since 1920. As ciated with steam turbine manufactu and installation for 40 years. Mr. M honey entered the employ of Gener Electric in 1903. Mr. Howard receiv his technical education at the Unive sity of Oregon and Cornell Universit He became affiliated with General Ele tric in 1916. Mr. Howard is a membe of the American Society of Mechanic Engineers.

A new division of the appliance a merchandise department to be know as the resin and insulation materia division has been formed with E. Feininger as manager. The new di sion will be responsible for the ma facture, engineering and sales of i sulating varnish, glyptal, varnish cloth and mica products. C. K. Me has been made sales manager of t division, C. S. Ferguson engineer a H. K. Collins superintendent. The di sion will be headquartered in Schen tady, with the exception of Mr. Mea sales operation, which will remain te porarily in Bridgeport.

A native of Troy, N. Y., Mr. Feinin has been with General Electric since was graduated from Rensselaer Po technic Institute in 1912 and has be associated with the varnish and m products department since 1926. M Mead has been manager of glyptal a insulation sales with headquarters Bridgeport since 1937. Messrs. Fer son and Collins have been identifi with the varnish and mica departme for several years, and Mr. Kilgore h been in the construction materials di sion of the appliance and merchandi department since 1937.

W. A. Mann has been appoint assistant manager, industrial divis of the company's central district, C cago. He has been with General El tric since 1923.

Frank P. Nemec has been nam manager of purchasing division of company's lamp department at N Park, succeeding the late Fred Harris.

•

▶M. C. WESTRATE, formerly of engineering department, Commonwea & Southern Corp., Jackson, Michig

signed to take a position as chief ...eer, Communication Equipment & ngineering Co., Chicago.

H. S. ORCUTT, formerly assistant engineer, Consolidated Edison Co. of New ork, Inc., is now with the Federal adio & Telephone Co., East Newark, J.

JOHN C. SYKORA has been made a ce-president of the Gould Storage Batry Corp., Depew, N. Y. Mr. Sykora s been with the Gould organization r nearly a quarter of a century, havg entered the New York office in 19. Eight years later he was transrred to Depew as assistant to the neral sales manager. Mr. Sykora has ade his headquarters in Depew since 27, except for one year when he acted special representative of the Gould mpany in Washington, D. C. In 1940 was made sales manager.

RAYMOND G. CARROLL, for the past veral years manager of the transportion department of the Virginia Elecic & Power Co., at Norfolk, Va., has en transferred to Williamsburg to ve charge of all the company's propties in that area. JOHN A. DAVIS, forerly connected with the transportation partment of the El Paso Electric Co., Paso, Tex., has been named to suced Mr. Carroll in Norfolk.

J. F. ANDERSON, formerly assistant the president, Continental Diamond bre Co., Newark, N. J., has recently en made vice-president. Mr. Anderon is affiliated with the laminated prodts, the manufactured electrical mica d the vulcanized fibre sections of the ational Electrical Manufacturers Asciation.

LYMAN W. ROBINSON has been apinted assistant secretary in charge plant accounting for the Consumers wer Co., Jackson, Mich., succeeding late M. Cedric Dowling. Mr. Robson joined Consumers Power as a nior engineer immediately after gradtion from Iowa State College in 1923 d has been employed by that utility d affiliated companies ever since. r a time he was assigned to transssion line design and construction. ter he was transferred to the planng and estimating section. By 1928 had charge of the making of all ctrical construction estimates reired by the Michigan, Illinois, Inna, Ohio and Tennessee affiliates the Commonwealth & Southern Corp. hen the program of reclassifying utilplant accounts was begun in 1938, . Robinson was placed in charge of engineering phases of the Pennsylnia Power Co.'s plant reclassification ogram. Later he spent a year in orgia and a shorter period in Ala-

Aid in today's emergencies

KLEIN'S

Communication lines are jammed with vital messages —power lines are carrying greater loads than ever before. To keep lines working in the face of today's emergencies is the job that Public Utilities are ably performing.

The ability of Klein quality equipment to meet the demands of this unusual service is proving the foresight of those men who demanded the best when purchasing pliers and climbers, safety straps and belts, grips and wrenches.

Of necessity, Klein production today is largely devoted to supplying the needs of the Army and Navy. It is important therefore that every piece of equipment in civilian use be properly cared for to assure it's delivering the long life which is inherent in any product carrying the name KLEIN.

To aid in making tools last longer, give better service, Klein has prepared a booklet, "Long Life to Tools," a copy of which will be mailed to anyone interested.

This book on the care and safe use of tools will be sent without charge on request.

ASK YOUR SUPPLIER

Foreign Distributors: International Standard Electric Corp., New York

Mathias KLEIN & Sons
Established 1857 — Chicago, Ill., U.S.A.
3200 BELMONT AVENUE, CHICAGO

FOR CORRECT ENGINEERING STANDARDS SPECIFY SHELDON

OUR 80-page catalog, plus years of concentrated specialization in the Designing, Engineering and Manufacturing of ELECTRICAL CONNECTORS are helping many a manufacturer of Electrical & Electronic instruments & equipment make his products better; faster; less costly. Let us talk with you about Electrical Connectors?

SHELDON
SERVICE CORPORATION
Long Island City, N. Y.

"YOU'RE WELL CONNECTED WITH SHELDON"

EXTRA MANPOWER with GREENLEE BENDERS

Shown above is the Greenlee No. 770 Bender with radius shoe attachment. With one forward stroke of the ram, a smooth, neat-looking, 90° bend is made in a jiffy.

● It's easier to get along short-handed these days if you have tools to eliminate long, tedious hours of hard work. And there's less absenteeism, too, when you have tools that lessen the physical strain on your men. Good tools provide extra manpower—help get more work done—speed up jobs. When you need better tools for essential jobs, investigate the current line of Greenlee Tools. You'll find Greenlee Benders, for instance, will provide extra manpower for all bending jobs, large or small. They are powerful, portable, easy for one man to operate.

There's A Greenlee Bender For Every Job!

Whatever you have to bend—tubing, E.M.T., heavy-wall conduit, or bus bar—there's a Greenlee Bender, including powerful hydraulic units, that will help ease your manpower problems.

SEND FOR BENDER BOOKLET NO. 5-116

Greenlee TOOL CO.
1808 Columbia Ave. • Rockford, Illinois

bama, doing similar work for C. & S companies. He returned to Jackso the summer of 1941 to work on the final check of the Consumers Power Co. reclassification. Since October, 1941, Mr. Robinson has been with the Commonwealth & Southern general engineering department in Jackson, working on special assignments, including the investigation of special plant protection required during the war period.

▶ HENRY ISAACS, formerly manager of the Reliable Electric Supply Co., Lawrence, Mass., has been appointed purchasing agent of the Eagle Electric Supply Co., Boston, Mass.

▶ JAMES A. SMITH, assistant superintendent of the Copperweld Steel Co., Glassport, Pa., has been appointed general superintendent of the plant. Mr. Smith joined the Copperweld organization in 1920, when the mill was located at Rankin, Pa. He served in the capacity of shipping foreman until 1932, when he became fabricating superintendent. In 1939 he assumed the duties of assistant superintendent.

OBITUARY

Norwood W. Brockett

Norwood W. Brockett, for many years public relations counsel for the Puget Sound Power & Light Co., Seattle, Wash., died on July 19 in Seattle, in his sixty-fifth year. Mr. Brockett was widely known in utility circles in the Northwest.

A graduate of the University of Minnesota Law School, Mr. Brockett went west, and after engaging in newspaper work for two years joined the old Snoqualmie Falls Power Co., a predecessor company of Puget Sound Power & Light, as assistant counsel. From that time until his retirement in 1931 he remained with that utility.

Mr. Brockett was one of the group who organized the present Northwest Electric Light and Power Association and he served as its secretary during its first five years. He was elected president of the association in 1922. During his association with the society he was active in its public relations and in handling questions of legislation affecting the utility industry.

•

▶ FREDERICK F. SKEEL, commercial vice-president of the Crouse-Hinds Co., Syracuse, N. Y., in the western district for some 40 years, died at his home in Chicago on June 25. Mr. Skeel was born at Fairfield, N. Y., in 1870 and became identified with the Crouse-Hinds organization at Syracuse in 1900

the capacity of advertising manager. He was soon appointed to take charge of the Chicago office, which included practically all of the territory west of Ohio, Kentucky and Mississippi. As the business of the company expanded it became necessary to establish branch offices in the western territory, which were added to from time to time and ultimately reached the total of eleven. In recognition of his accomplishment in building up this territory Mr. Skeel was made commercial vice-president. Although he retired from active business about two years ago because of ill health, he remained in almost daily contact with the organization up to the time of his death.

B. A. GERMAN, manager at Pinckneyville, Ill., for the Illinois-Iowa Power Co., died suddenly, on July 6, while working in his office. Mr. German was a native of Eldorado, Ill., and was 48 years of age.

LEWIS G. WEBBER, 51, New England representative of the Gehnrich Corporation, Long Island City, N. Y., died at Bedford, Mass., on July 16.

ERNEST W. WRIGHT, senior accountant of the Massachusetts Department of Public Utilities, and employed by that commission since 1915, died in Boston on July 16.

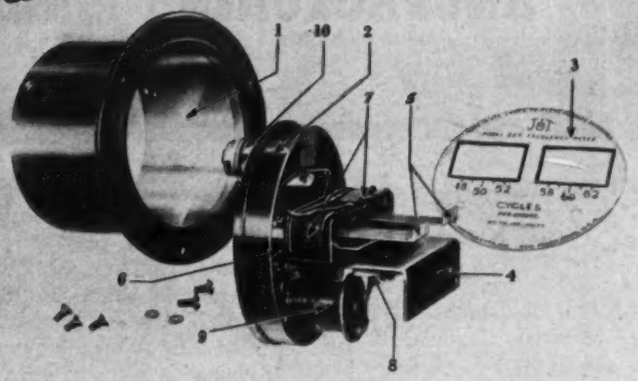
L. D. SHANK, city manager of Dover, Del., since 1929, and formerly superintendent of the Dover lighting department, died on July 18 at his home in that city.

E. F. MCKAY, for many years manager of the Oklahoma Utilities Association with headquarters in Oklahoma City, died on July 4 in Washington, D. C., where since 1935 he had been connected with the Federal Communications Commission.

ZECHARIAH CHAFFEE, 84, president of the Builders' Iron Foundry, Providence, R. I., since 1889, and responsible for bringing the manufacture of the Venturi meter to that city, died near Taunton, Mass., on July 8. He was at one time secretary of the Brown & Sharpe Mfg. Co., Providence, and was prominent in banking, insurance and educational circles.

WILLIAM E. DOLL, 54, president of the Gustavo Preston Co., Boston, Mass., representative of Yeomans Bros. Co., Chicago; the Pennsylvania Pump & Compressor Co., Easton, Pa., and other power plant equipment manufacturers, died at his home in Swampscott, Mass., on July 22. He was born in Denver, Colo., and for 16 years was sales manager of the Worthington Pump & Machinery Co., at St. Louis and Detroit, going to Boston in 1931 as head of the Preston company.

What makes it RESONATE?



J-B-T Model 30-F Vibrating Reed Frequency Meter with case removed

1. Case
2. Base
3. Dial
4. Mounting Frame
5. Spring Steel Reeds
6. Reed Mounting Bar
7. Driving Coil
8. Permanent Magnet
9. Series Resistor
10. Terminal Studs

HOW DOES IT WORK? By resonance. As the current flows through the driving coil, the frequency with which the current alternates or is interrupted determines the number of magnetic pulls per second on the reeds. Each reed is preset during manufacture to respond to but one frequency – by combining parts of the proper strength, dimensions and weight. The reed which is "in tune" *RESONATES*, which means that it vibrates to full amplitude – the others little or not at all. Simply READ the REED, and that's your frequency.

DON'T ALL THE REEDS VIBRATE? No, not now. Since the introduction of the original principle, J-B-T basic improvements have virtually eliminated sympathetic mechanical vibration. Reeds on either side of the reed which is vibrating to *full* amplitude also vibrate, but to a much more limited extent, and actually help to indicate the frequency more accurately, particularly if it is fractional.

CAN THEY TAKE IT? Yes, sir. Thousands of J-B-T Vibrating Reed Frequency Meters now in use are standing up where the going is *tough*. Day in, day out they are measuring cycles per second, revolutions per minute, and frequencies for wartime uses.

HOW DO YOU ADJUST THE METER WHEN IN USE? You needn't. Once calibrated at the factory, it is permanently accurate. It requires no adjustment to compensate for wave form, external magnetic fields, voltage variation (±20%), or normal operating temperatures.

YOU SAY PERMANENTLY ACCURATE, BUT HOW ACCURATE? Within ±0.3% for full cycle increments, ±0.2% for half cycle increments in the 60 cycle range, for instance. A 400 cycle meter is accurate to within ±0.3%.

WHAT ABOUT POWER CONSUMPTION? It is exceptionally low, ranging from less than 2 watts at 400 cycles at 115 volts – to ½ watt at 60 cycles at 115 volts – depending on the model.

IS THE CONSTRUCTION THE SAME FOR ALL MODELS? No. These instruments are available in full range of frequencies, voltages, reed groupings and case sizes. Models are designed to fit the application. J-B-T engineers will be glad to help you get the RIGHT meter for your requirements.

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S-JBT-6

J-B-T INSTRUMENTS, INC.

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MANUFACTURING-MARKETS

Launches Wartime "Idea Exchange"

The Nash-Kelvinator Corp. has just made public the full details of a new project designed to broaden the exchange of ideas and suggestions for solving wartime homemakers' problems. Here is how it operates:

1. Each month Kelvinator will announce to the nation's home economists, by means of a four-page front-of-the-book supplement in the magazine, "What's New in Home Economics," a timely "project" selected in advance by a panel of Washington authorities. Project number 1, already announced, covers the subject "Aids to home preservation of fall vegetables and fruits."

2. Forty war bonds will be offered to those home economists who offer ideas and suggestions on the current subject.

3. A board of judges will select the 40 best contributions.

4. Kelvinator will then publish each month's selections in a series of pamphlets, entitled "Helps for Homemaker."

"Because the project is keyed to the solution of currently anticipated real problems, there will be no lost motion in either gathering or disseminating 'general' home-making information," said C. T. Lawson, general sales manager of Kelvinator, in announcing the "Kelvinator Wartime Idea Exchange." "We are pleased with the practical simplicity of the project and feel confident that it will be of very real service to a great portion of our 30,000,000 homemakers . . ."

•

Underwriters Laboratories Issue New Listings

Underwriters' Laboratories, Inc., have recently issued a new and revised list of inspected electrical equipment. The list contains summaries of listing card reports on electrical equipment, which has been examined with reference to fire and accident hazards and for conformity with the provisions of the National Electrical Code applying to its installation and use.

"CONSERVICE" RESULTS—More than 4,000 appliance service men such as the ones shown above have taken the Westinghouse "Conservice" appliance repair training course during the past six months. In the photo, Dale Balph is tracing the circuit of an electric coffee maker at a Westinghouse Supply school for Ohio dealers

Manufacturers Issue Earnings Report

General Cable Corp. for the six months ended June 30 reports net income, after $4,670,000 provision for Federal taxes on income, of $1,041,888, against $1,367,623 net income for the similar period last year, after $6,975,000 taxes.

Among the other companies issuing reports are the following:

BLAW-KNOX—Including subsidiaries, six months to June 30, net profit, after $4,741,002 taxes, was $780,728, equal to 59 cents a share, against $585,434, or 44 cents a share, after $4,418,050 tax charges last year.

JOHNS-MANVILLE—Including subsidiaries, second quarter net income was $1,059,802, or $1.19 a common share, compared with $1,103,054, or $1.24 a share, for the similar period of 1942. Sales for the June, 1943, quarter amounted to $27,274,765, against $26,871,075 for the similar 1942 quarter.

COPPERWELD STEEL—For six months, net earnings, $444,141, equal after preferred dividends to 75 cents each on 514,864 common shares, against adjusted net of $597,868, or $1.06 a common share last year.

ACME STEEL—Including subsidiary, June quarter, net profit, after estimated $1,609,754 excess profits taxes and $220,462 normal and surtax, was $509,554, equal to $1.57 each on 328,108 shares of $25 par capital stock. This compares with $422,316, or $1.28 a share, in preceding quarter and $380,285, or $1.16 a share in second quarter of 1942.

•

Westinghouse Output at Record Level

Westinghouse Electric & Manufacturing Co. reached record production in the first half of this year, with billings totaling $322,559,295, a 35 percent increase over the corresponding period last year, A. W. Robertson, chairman, reports. Unfilled orders valued at $946,182,753 also exceeded those of a year ago by 35 percent.

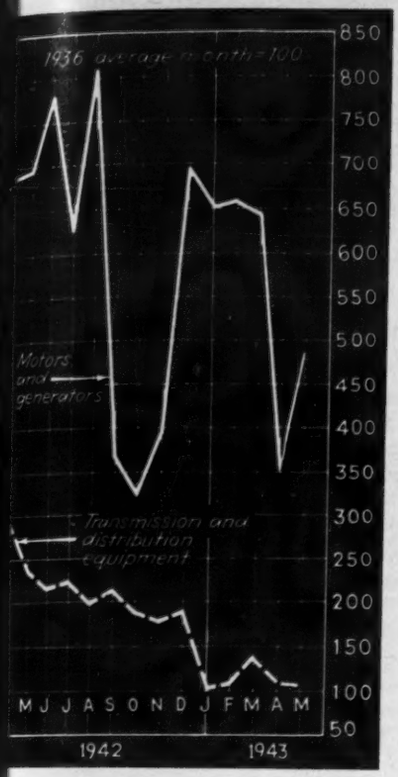
Net income for the six months ended with June, after provision for renegotiation of war contracts, amounted to $9,480,271, equal to $2.95 a share on the common and preferred stocks. This compares with $6,731,712, or $2.10 last year.

The 1943 profit is after allowances of $3,038,270 for post-war contingencies, $5,198,329 income taxes and $28,102,227 excess profits tax after post-war refund of $3,122,469. In the first half of the previous year, income taxes were $4,395,169 and excess profits tax, $41,239,775.

Orders booked during the first half of 1943, totaling $473,631,033, were 13 percent below the total for the corresponding period last year.

Generator Orders Recover in May

Orders for motors and generators, which registered such a sharp drop in April, turned upward in May, but the volume was considerably below that of a year ago, according to the index compiled by the National Electrical Manu-



EMA INDEX, value of orders received

facturers Association. Orders for transmission and distribution equipment were practically unchanged in May.

The index of orders for motors and generators advanced 115 points, or 32 percent, to 471. The figure, however, was 226 points, or 32 percent, below the index of 697 for May of last year. The index for transmission and distribution equipment was 113, an increase of 1 point over the revised figure for the previous month. In comparison with the corresponding month of last year, however, the index is down 124 points, or 52 percent.

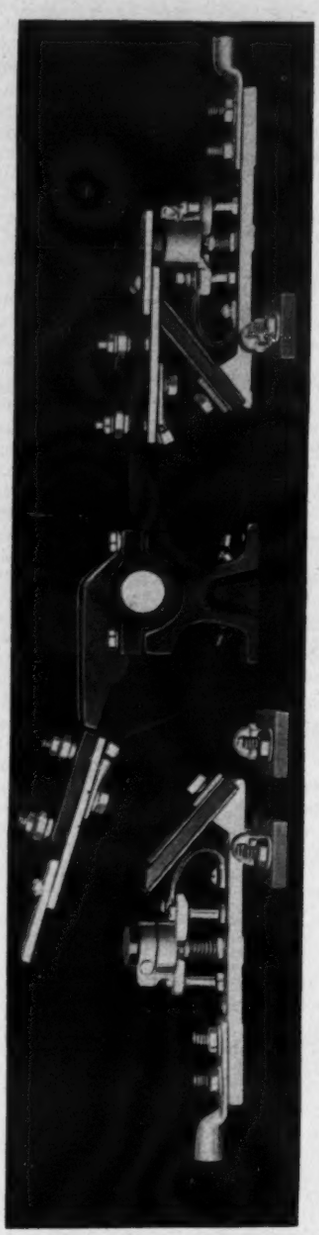
•

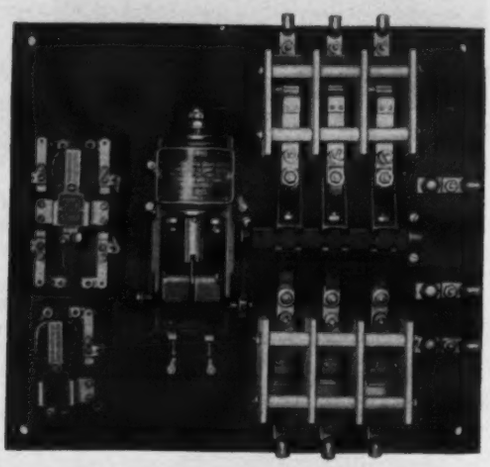
Army-Navy "E" Award

Among recent recipients of the Army-Navy "E" award were Westinghouse Electric & Manufacturing Co., Meter division; Allis-Chalmers Manufacturing Co., La Porte works, La Porte, Ind., and Borg-Warner Corp., Norge division.

ASCO *Electrically Operated* SWITCHES

PLUS VALUES





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ASCO Transfer Switches, designed to protect operations against main power failures, in themselves create no risk of failure. That in a nut-shell sums up their PLUS VALUES . . . what makes them the better buy. Further details will be found in Catalog 561.

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Field Reports on Business

Engineering construction awards continue to decline; Western building off 45 percent; wholesalers' stocks and business both show slight improvement; DPC allocations show expansion still going on.

NEW ENGLAND

The announcement last week that the New England Shipbuilding Corp., Portland, Me., has been allotted contracts for 115 Liberty type cargo vessels for the Maritime Commission should hearten manufacturers of electrical equipment. DPC allocations for additional equipment for plants engaged in war work indicate that expansion in certain directions is still going on for meeting the demands of various armed services. An increase in allocations to Raytheon Production Corp., Newton, Mass., amounting to $35,000, was authorized recently and Wickwire-Spencer Steel Co. has received $85,000 for additional machinery in a Massachusetts plant.

The Navy has awarded a contract for pumping equipment to S. Cassedy, Cambridge, Mass., for $26,500. Refrigerating alterations and repairs costing $1,500 at another naval base will be handled by R. I. Lutz Engineering Co., Providence, R. I. Construction work under the direction of the Bureau of Yards and Docks is active. Contracts for additions to shops and extension of power and lighting lines ranging in cost from $35,000 to $50,000 have been allotted contractors during the past fortnight.

Supplies for lighting installations and power circuits will be needed in sizeable quantities for new contracts awarded here, including quarters at a Connecticut submarine base costing $232,000; two lookout stagings which will require special communication materials and will be built at a cost of $12,500 each, and guide lights and signaling installations at Nantucket costing over $100,000. A school and dispensary will be built by the Navy in Connecticut at a cost of $212,760; F. H. McGraw Co., Hartford, Conn., has the contract.

CHICAGO

With the $26,440,000 expansions authorized here in the last month, Chicago's industrial facilities have been increased by $110,329,937 since the start of 1943, according to the Chicago Association of Commerce. War industries that announced plant additions here in July included Borg-Warner, Buick Aviation, Inland Steel, Texas Company, Tantulum Corporation and Lindberg Steel Treating.

Employment in Chicago manufacturing industries continues the upward trend that has prevailed during the last year. It has increased 8 percent between May 15 and June 15 to a level 18 percent higher than June 1942. Building construction and contracting groups for this period, however, again reported sharp decreases in employment and payrolls, according to the Illinois Department of Labor.

Power output for the central industrial area was up 13.2 percent for the week ended July 24 over the same week of 1942. Output of the Commonwealth Edison group of companies was 14.7 percent for this week over last year. Operating companies of the Standard Gas system showed an increase of 14.2 percent and the Northern States Power Co. 9.6 percent.

Electrical manufacturers on the whole report little activity on standard lines. One of the electrical equipment manufacturers in the Chicago area booked an order this week for a substantial number of welding cable connection boxes for a naval yard. Production of special ordnance equipment for the army and navy is sustaining normal production activity. Hotpoint, for example, is producing compressed-air-powered, automatic 50-calibre anti-aircraft machine gun trainers used in the training of military personnel. These trainers simulate battle conditions of vibration, sound and shock by artificial means with a "gun" that shoots plastic pellets at scale-model aircraft. The trainer was developed and perfected by Hotpoint.

NEW YORK

Consolidated Edison reported recently that its Hudson Avenue, Brooklyn, steam-electric generating station hit an all-time record June 21 when at 10 a.m. its boiler house produced sufficient steam to operate the plant at its full rated capacity of 770,000 kw. Later, on June 29, gross output of Hudson Avenue reached a new all-time high for the 24-hour period amounting to 13,795,000 kw.-hr. Output generally for the system is running close to 30 percent over 1942.

Civil engineering construction volume in continental U. S. totaled $41,154,000 for the latest week, 16 percent lower than the preceding week and 84 percent below the corresponding 1942 week, according to *Engineering News-Record*. The current week's volume brings the 1943 construction total to $2,062,540,000, which on a weekly average basis is 65 percent below the 31-week period in 1942.

The pinch of decreasing inventories in the retail consumer's goods field has yet to slow up the buying wave, according to figures of the Federal Reserve Board. Department store sales for the week ended July 24 were 19 percent over the 1942 week nationally and 18 percent up for the last four-week period. New York's gain was 12 percent.

PACIFIC COAST

Total value of June building permits in the seven Western states was $13,035,000, a decrease of 45 percent from last year's corresponding figure, despite the fact that both Washington and Oregon showed 30 percent increases. Wholesalers report fair brisker business during the latter half of July after a slow opening fortnight; stock conditions are steadily improving, aided by some brisk combing of Eastern factories for available and permissible substitutions—especially of wire.

Recent large service installations include a $1,703,304 award for an amphibian training base. Naval Ordnance shop building costing about $2,500,000, and an Army base costing $3,000,000. Orders include a considerable transformer oil award to Westinghouse by the Bonneville system; $16,96 of radio equipment for the Ampere, Wash. substation; a low bid of $53,236 for two diesel-electric locomotives for the city of Tacoma; 40 and 80-ton cranes for Friant Dam; $40,000 of G.E. switchgear equipment for a naval air base overseas, and 1,000 fractional-hp. motors for pressure pumps.

Utility Wins Appeal On Line Erection

Haverhill Electric Co. has won an appeal to the Massachusetts Department of Public Utilities against the city council's authorization of the installation and erection of a 550-volt line along a conduit under Locust and Locke Streets by the L. R. Hamel Leather Co.

The state board held that nothing in the city's order granting the Hamel petition or in the subsequent proceedings of the municipal council indicates that any restriction to private use was intended; indeed, it appeared that the purpose was to resell electrical energy to tenants of the Hamel company. It also appeared that it would be possible for the Hamel company, if it obtained the right to cross the public ways with an electric line as requested, and was able to obtain the energy, to sell electricity to a large number of persons, including both its tenants and members of the general public, without crossing another public way.

Haverhill Electric is not required to prove an intention on the part of the Hamel company to resell to the public. There was evidence that previous sales of energy to tenants have been made with the utility's consent, but this does not constitute a waiver by the utility of its right to object to the granting of a location in the public streets to the leather company. There is no evidence that the utility has not been adequately serving the territory or that the Hamel company could not obtain adequate service at reasonable cost from the utility. The commission states that the granting of the order in its present form would incite further controversy and would not promote public interest. The order of the municipal council was therefore reversed by the state board.

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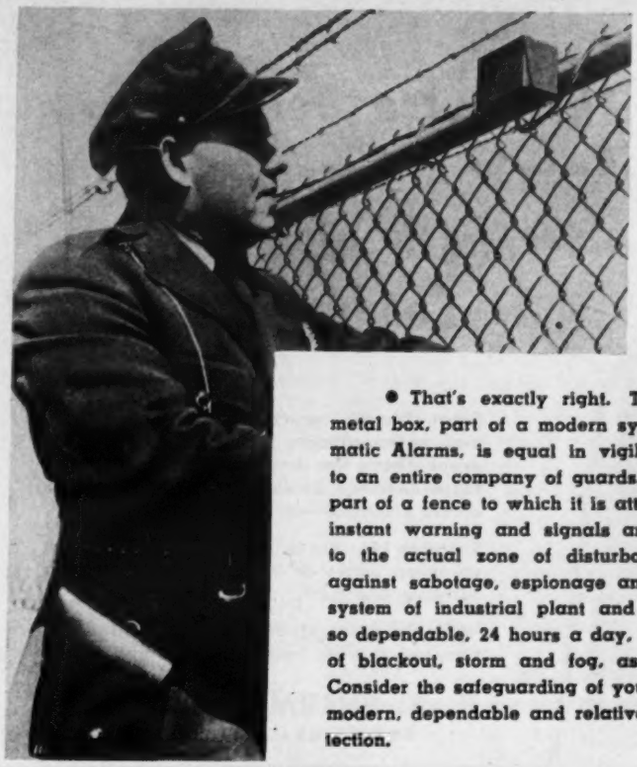
Kentucky P.S.C. Reports on Savings

In a Kentucky Public Service Commission report, made public recently by Gov. Keen Johnson, annual savings of $7,048,001 and accumulated savings of $33,793,729 for customers of privately owned utilities in Kentucky have been effected, the report declares, during the eight years the commission has been in existence.

In addition, the commission reported that economies had made it possible to reduce the assessments against utilities from $100,000 charged in the fiscal year just ended to $75,000 for the current period. Utilities are assessed under state law to pay the commission's expenses and the legal maximum assessment is $130,000.



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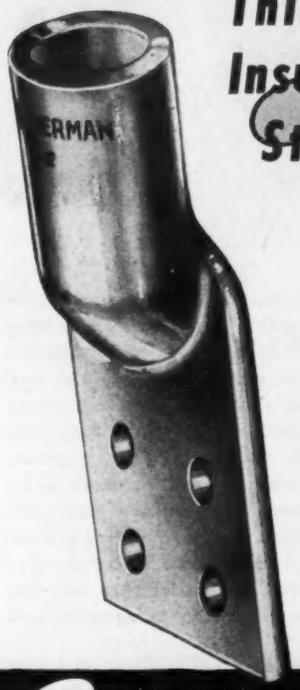

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Extra strength, to withstand any stresses — plus extra capacity to insure minimum IR drop! That's the combination that has made these Sherman Soldering Lugs the standard of the electrical industry.

Sherman Lugs are bright and clean, too, with no sharp edges or burrs — and the contact surfaces are FLAT.

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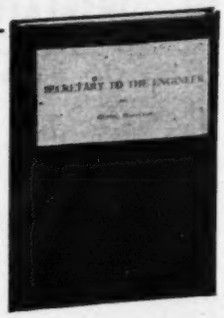

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SALES OPPORTUNITIES

OREGON—Pacific Power & Light Co., Portland, has approved plans for relocation of transmission line, changing present right-of-way which is on lands to be used for an airport. Project will include new overhead line across Lewis and Clark River. Work will be carried out by company forces and will be placed under way soon.

MICHIGAN—Nash-Kelvinator Corp., 1425 Plymouth Avenue, Detroit, now in production for war materials for government, will carry out expansion in plant, including new building, with installation of mechanical and electrical equipment and facilities. Cost about $1,660,000, with financing by Defense Plant Corp. Work is scheduled to begin at early date.

OKLAHOMA—U. S. District Engineer Office, Tulsa, Okla., has completed plans for new air freight terminal, comprising hangars, shops, warehouses and other buildings, with mechanical and electrical equipment. Also electrical distribution lines, control station and other operating facilities. Cost estimated about $500,000. Work will begin at once.

UTAH—Bureau of Reclamation, Denver, Colo., has plans under way for reconstruction of Scofield dam, Price River Valley district, to be 56 ft. high, 420 ft. long, with crest of 30 ft. Appropriation of about $640,000 has been authorized for project.

NEW YORK—Bell Aircraft Corp., 2050 Elmwood Ave., Buffalo, will carry out expansion in a plant, with installation of additional mechanical and electrical equipment for increased capacity for government. Cost estimated close to $450,000, with financing by Defense Plant Corp. Proposed to begin work soon.

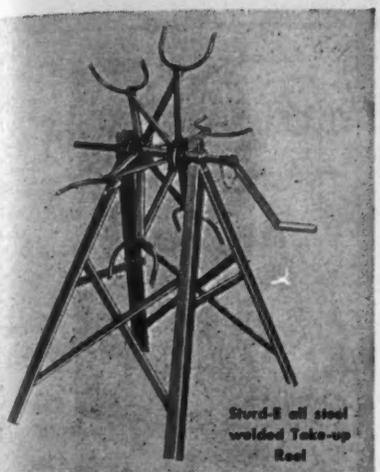
NEW YORK—Consolidated Edison Co., New York, has approved plans for alterations and improvements in generating station in Bronx. No estimate of cost announced. A building permit has been issued and work is scheduled to proceed at once.

MONTANA—War Department, Washington, D. C., has approved plans for new air force base, comprising hangars, shops, warehouses and other structures, with mechanical and electrical equipment. Also will install power substation facilities, with electrical distribution lines, service connections, controls, etc. Entire project will cost over $1,000,000, and will be supervised by U. S. District Engineer Office, Seattle, Wash.

TEXAS—Goodyear Tire & Rubber Co., Akron, Ohio, has contracted with government for expansion in synthetic rubber mill, including new building and installation of mechanical and electrical equipment for increased capacity. Cost estimated about $1,250,000, with equipment. Financing by Defense Plant Corp. Work will be carried out soon.

TEXAS—Board of Public Service, San Antonio, has secured approval of WBP for new municipal power station in building on Concepcion Rd., to be remodeled and equipped for this purpose. Installation will include a 30,000-kw. turbine-generator unit and auxiliary equipment. Completion is scheduled late in 1944.

ALABAMA—War Department, Washington, D. C., has authorized new air force



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VALUE—UTILITY *and* LIFETIME SERVICE

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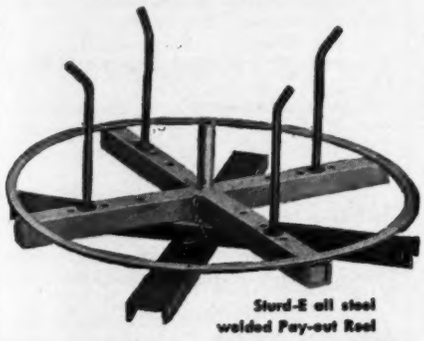
a **TRUE TEMPER** **PRODUCT**



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base, comprising hangars, shops, warehouses and other buildings, with mechanical and electrical equipment. Also power substation with electrical distribution lines, service connections and other facilities. Entire project will cost about $1,000,000, and will be supervised by U. S. District Engineer Office, Mobile. Work is scheduled to begin at once.

MINNESOTA—Stainless & Steel Products Co., 1000 Berry Ave., St. Paul, plans early construction of one-story addition, to be equipped as a power substation for plant service.

GEORGIA—Goodyear Clearwater Mills, Cedartown, manufacturers of tire fabrics, plan expansion and improvements in branch mill, with installation of machinery and electrical equipment for manufacture of twisted tire cords of high tenacity rayon yarns. Conversion program will cost approximately $1,280,000, and will be carried out at early date. Project has been approved by WPB.

OKLAHOMA—U. S. District Engineer Office, Tulsa, is planning early call for bids for new Fort Gibson dam on Grand River, to be about 110 ft. high, forming a reservoir of approximately 50,000 acres. Appropriation of $8,400,000 is available for construction. Structure has been designed for a hydroelectric power development, to be carried out at a later date, with installation to provide an initial capacity of 45,000 kw.

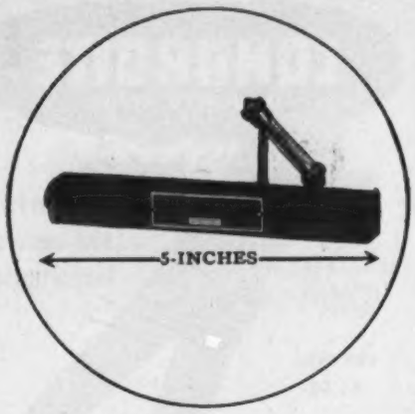
MISSOURI—Civil Aeronautics Authority, Washington, D. C., and City Hall, Kansas City, Mo., has surveys and plans under way for new airport, comprising hangars, shops and other structures. Also electrical distribution lines, with control station, lighting system and other operating facilities. Fund of $600,000 has been authorized for project, which is scheduled to be carried out early in 1944.

NEBRASKA—War Department, Washington, D. C., has approved plans for new military cantonment, comprising shops, warehouses and other utility buildings, with mechanical and electrical equipment. Also barracks, administration building and miscellaneous structures. Power substation facilities will be provided, with electrical distribution lines, service connections, controls, etc. Entire project will cost over $1,000,000, and will be carried out at once under supervision of U. S. District Engineer Office, Omaha.

WASHINGTON—Western Gear Works, 417 Ninth St., South, Seattle, manufacturer of gears, transmission systems, etc., will carry out expansion in plant for production for government, including new building with mechanical and electrical equipment and facilities for considerably increased capacity. Cost estimated close to $350,000, with financing by Defense Plant Corp. Work is scheduled to proceed at early date.

TENNESSEE—Upper Cumberland Electric Membership Corp., Carthage, plans construction of new transmission line, about 22 mi. long, for main power supply line. Cost estimated close to $75,000. Financing has been arranged and project approved by WPB.

WASHINGTON—Civil Aeronautics Authority, Washington, D. C., and Smith Tower Annex, Seattle, is arranging immediate call for bids for new airport, comprising hangars, shops and other structures, with mechanical and electrical equipment. Also electrical distribution lines, control station, lighting system and other facilities. Cost estimated about $865,000.



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There is no guessing with a Matthews Teleheight. Any lineman can be taught to use it and get any height within an inch or so. He can learn in five minutes.

The extra cost of just one wrong guess will pay for one or two Matthews Teleheights. Hundreds of them are saving lots of money for their owners all over the country. Many are being used for quickly figuring the cubical contents of buildings, the clearance of bridges, highlines, etc.

Matthews Teleheight is only five inches long. Has no moving parts. It is furnished with a leather carrying case that will fit in the vest pocket. The drawing below shows how simple are the directions for using it.

Great for Appraisal Jobs.

Try one at our risk of your approval.

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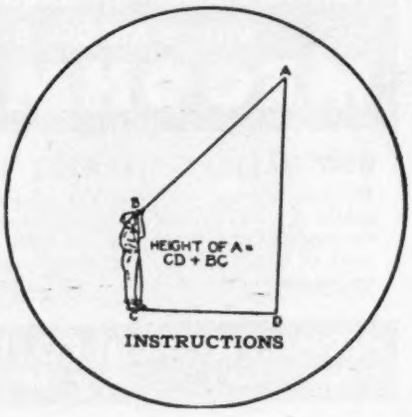

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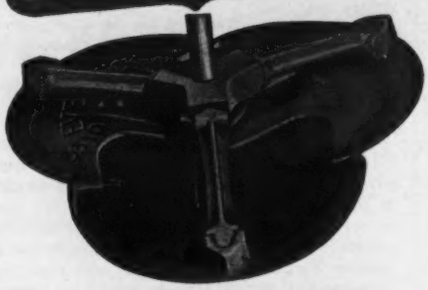

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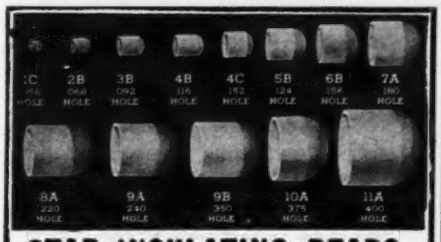

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Use LAVOLAIN ball and socket beads for insulating bare wire. Heat resistant. High di-electric and mechanical strength. Made in U.S.A. Quality beads at low cost. Quickly applied. Flexible. Beads shown above are approximately half actual size. Ask for price list and samples.

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Cartridge Fuse Tongs
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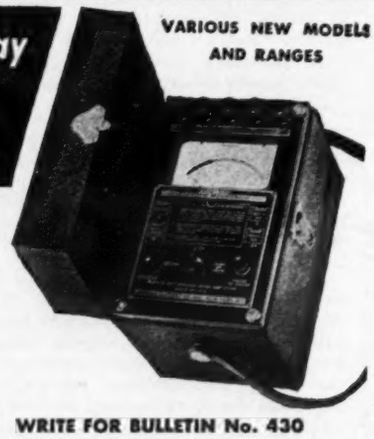
No more tiresome cranking of a hand-driven generator . . . Entirely self-contained, steady test potential of 500 volts DC, available at the touch of a switch. Direct reading in insulation resistance.



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WRITE FOR BULLETIN No. 430

LETTERS TO THE EDITOR

Wiring Economies Under Wartime Code

To the Editor of ELECTRICAL WORLD:

The article "Wiring Economies under Wartime Code," by L. C. Peterman, in your issue of June 26 is a very interesting contribution to the general progress of the industry. I hope that the National Electrical Code will wake up to such constructive economies.

J. C. RUNYON
Falls Church, Va.

•

Selecting Load Dispatchers

To the Editor of ELECTRICAL WORLD:

I have read with interest your editorial on selection of load dispatchers (July 10, 1943).

I would appreciate it if you would supply me with the addresses of sources from which I could obtain the aptitude tests which are especially of use in the training and selection of load dispatchers.

H. K. MCKEAN,
Chief Load Dispatcher,
Indiana Service Corp., Fort Wayne.

[NOTE:—We are glad to give herewith some references to tests which, among others, seem appropriate. They are from a considerably longer and more generalized list by the Personnel Research Division of the extension services of Pennsylvania State College:

Test

1. Army Alpha Examination, The Psychological Corp., New York.
2. The Wonderlic Personnel Test, E. F. Wonderlic, 919 N. Michigan Ave., Chicago, Ill.
3. Adams-Lepley Personal Audit, Science Research Associates, Chicago, Ill.
4. Allport A-S Reaction, The Psychological Corp., New York.
5. MacQuarrie Test for Mechanical Ability, The Psychological Corp., New York.
6. Bennett Test of Mechanical Comprehension, The Psychological Corp., New York.
7. Purdue Test for Electricians, Research Associates, Purdue University.

Books

1. Aptitude and Aptitude Testing, by W. V. Bingham, Harper & Brothers, New York.
2. The Nineteen Forty Mental Measurements Yearbook, by O. K. Buros, Rutgers University Press, New Brunswick, N. J.
3. Psychology for Business and Industry,

s sir, that's all the time it takes to braze e three brass coupling rings to the steel amping in making these covers for Navy ge boxes.

at's speed. But that's not all. Those neat ints are water-tight, as they must be for arine service, and every bit as strong as e parts they join—and just as enduring.

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ARMY NAVY 1st AWARD August 1943 2ND AWARD February 1943

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by H. Moore, McGraw-Hill Book Co., New York.

4. Occupational Counseling Techniques, by W. H. Stead and C. J. Shartle & Assoc., American Book Co., New York.

5. Industrial Psychology, by J. Tiffin, Prentice-Hall, Inc., New York.

6. Industrial Psychology, by Morris Viteles, Norton & Co., New York.

None of these, however, has tests exclusively for load dispatchers—EDITORS.]

•

In the Interest Of Efficiency

To the Editor of ELECTRICAL WORLD:

What engineer isn't interested in efficiency?

If Davis H. Tuck is, I suggest he turn from his horse and plow arrangement on page 147 of your July 10 issue to page 25. There Sangamo Electric Company shows how, by a simple change to oxen, he can get 500 more plows pulled at no extra expense.

Yours for the conservation of energy,

FRANK HAYLOCK,
Whitestone, L. I., N. Y.

•

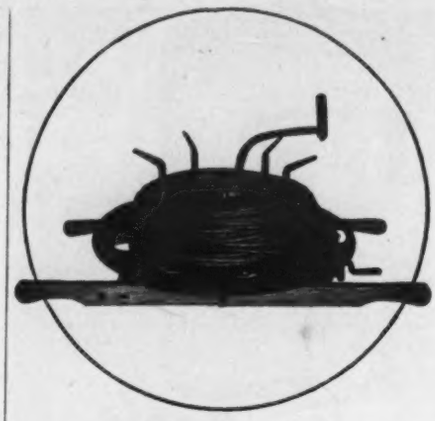
Railroad Electrification

To the Editor of ELECTRICAL WORLD:

A recent editorial in the esteemed ELECTRICAL WORLD (May 29, 1943) refers in a very interesting manner to railroad electrification in post-war development. While it is obviously too early now to visualize with any degree of accuracy what the post-war picture will be so far as transportation is concerned, whether rail, highway or air, a few points may perhaps be pertinently mentioned at this time.

The pressure on the railroads after the war will without doubt be increasingly heavy to render extremely fast and reliable service, both passenger and freight, if they are to compete successfully with other agencies. This will mean increasing concentration of horsepower capacity in locomotives which must be capable of hauling heavy trains at high speeds, for heavy trains are in many respects a measure of railroad operating efficiency.

No form of motive power yet developed permits concentration of horsepower capacity in a single locomotive to the extent that the electric locomotive does. This is particularly true of short-period overload rating. This overload rating permits rapid acceleration at start and after necessary slow-downs; it is necessary to maintain rapid schedules, and it also permits ascending relatively short grades without reducing speed. This short period overload ca-



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Matthews Adjustable Reels will save their cost many times over, as you can use wire in coils; thereby saving the cost of wooden spools, freight, and the bother and expense of returning spools for credit.

In 1928 one large power company in Ohio equipped all of their line trucks with Matthews Adjustable Reels. All these Reels are still in service, and this power company has bought many more since 1928.

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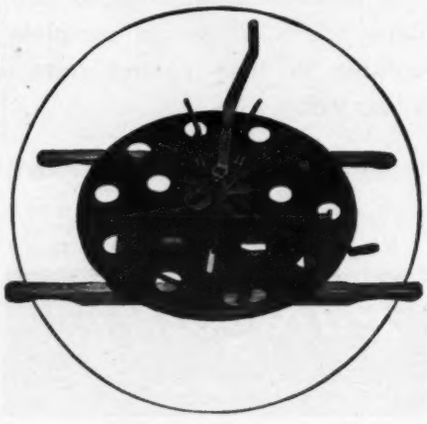

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pacity is a natural characteristic in the electric locomotive, whereas the diesel engine, as thus far developed, is not adapted to produce such overloads.

It seems probable, furthermore, that oil as fuel will be increasingly scarce, and thus costly, after the war, on account of increasing demands in the fields of marine and air service, as well as the highways, and this may seriously limit the general adoption of diesel equipment on the railroads.

The steam locomotive of standard design, with its reciprocating parts, presents definite problems of operation and maintenance, both of equipment and track, at ultra-high speeds, and these tend to limit its use in solving problems with which the railroads will be faced. The high-pressure turbine locomotive may be developed to handle this service, but even after a relatively long period of experimentation in various parts of the world it has not yet reached a point where it may be considered practical.

Taking everything into consideration, there would seem to be very little question that electrification will receive very careful consideration by many railroads in solving some of the post-war railroad problems. This is especially true if power companies can be persuaded to pass on to the railroads savings made possible by increasing thermal efficiency attained by recent developments in the art of generating power.

SIDNEY WITHINGTON,
Electrical Engineer,
New York, New Haven & Hartford Railroad Co., New Haven, Conn.

•

Kentucky Co-op Tax Upheld

The Court of Appeals at Frankfort, Ky., has approved taxation of rural electric co-operatives by refusing to reconsider its recent ruling in a test case brought by the Inter-County Rural Electric Co-operative Association of Danville, Ky. (ELECTRICAL WORLD, Apr. 10, page 10).

The ruling, which covers the property and franchise taxes, affects 26 rural co-operatives in Kentucky. The property tax of 50 cents per $100 of valuation includes lines, poles, wires, transformers, etc.

The franchise tax is assessed on the value of franchises determined by the State Tax Commission, which recently ruled that the rural electric co-operatives would not be made to pay franchise taxes under the high court decision. The Commission held that no valuation should be placed on the franchises of the co-operatives.

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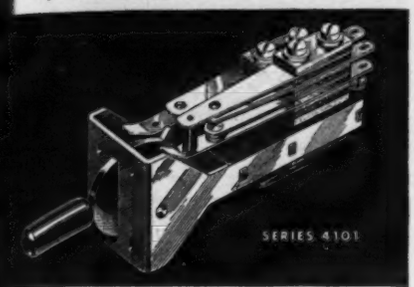

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This heavy duty multiple contact, positive action lever type switch, is available in five basic contact forms. Combinations of these may be built up for each individual application.

Contact Ratings: (1) Standard heavy duty contacts—3/16" diameter fine silver—10 amperes, 110 volts, A.C.—non-inductive. (2) Extra heavy duty contacts—5/16" silver alloy —20 amperes, 110 volts, A.C.—non-inductive.

Breakdown rating of springs to ground—1000 volts—alternating current.

Write for new catalog—now on the press—which illustrates the five basic contact forms; shows detailed drawings and tells about mechanical construction as well as other Mossman products.

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REA Announces New Allotments

The Rural Electrification Administration recently announced allotments totaling $266,000 to seven systems in six states and Alaska. The funds allotted will provide for extension of electric service to farms qualifying, under WPB regulations, on the basis of livestock, dairy and poultry production and, in the case of the Alaska system, for additional generating equipment.

In announcing the allotments, Administrator Harry E. Slattery stated that no construction will be undertaken except in accordance with authorization or regulations of the War Production Board.

These allotments, the first of the fiscal year, bring the total for the REA program to $467,212,295.

Details are as follows:

ALASKA—Kodiak Electric Association, Kodiak, $100,000.

IOWA—Grundy County Rural Electric Cooperative, Grundy Center, $22,000.

MINNESOTA—Freeborn-Mower Cooperative Light and Power Association, Albert Lea, $50,000.

MISSISSIPPI—Coast Electric Power Association, Bay St. Louis, $25,000.

MISSOURI—Barton County Electric Cooperative, Lamar, $20,000.

TENNESSEE—Volunteer Electric Cooperative, Decatur, $29,000.

WISCONSIN—Vernon Electric Cooperative, Westby, $20,000.

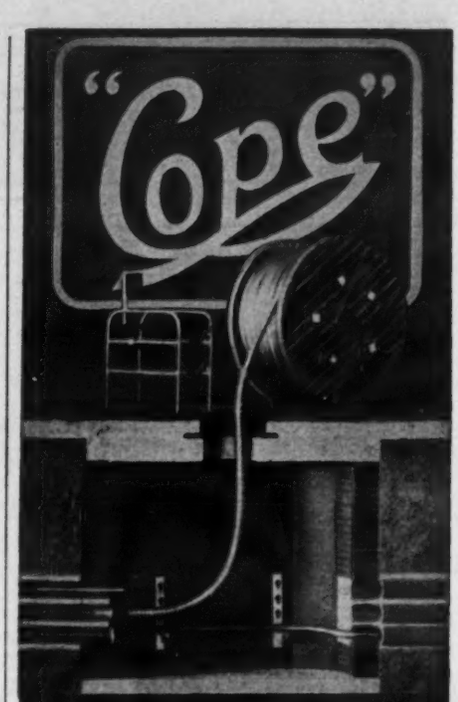
•

G.E. to Manufacture Home Dehydrators

To help preserve America's 1943 Victory garden crop, General Electric Co. will manufacture several thousand electrically heated and thermostatically controlled home dehydrators which are expected to sell at a retail price of $39.95 each, it was announced by H. L. Andrews, vice-president in charge of the company's appliance and merchandise department. These will comprise a part of the 100,000 total for which WPB recently allotted materials, upon recommendation of the Department of Agriculture.

Emphasizing the progress which has been made in home dehydration methods as the result of research during the past several years, Mr. Andrews described the new G. E. home dehydrator as a scientifically designed appliance which can produce a dehydrated food product vastly superior in taste, appearance and vitamin content to the "dried" foods of a generation ago.

"Cope"



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Development of the G. E. dehydrator was under the direction of Dr. Donald K. Tressler, Ph. D., formerly chief chemist of the Birdseye frozen food laboratories, also former chief in research at the New York State Agricultural Experiment Station and professor of chemistry in the School of Nutrition, Cornell University. Dr. Tressler is in charge of food research for the General Electric Consumers Institute.

•

WPB Interprets Three Orders

WPB has interpreted order L-203 (ELECTRICAL WORLD, June 19, 1943, page 4) with relation to approved orders. As issued, the order included as an approved order, to fill which no specific WPB approval was necessary, any order for less than 500 indicating instruments whose specifications conform to those published by the armed services, when the specifications are required by the order.

The interpretation makes it clear that this means specified by the Army or Navy, and not just by any purchaser who chose to require service specifications. Such specifications may occur on direct Army or Navy orders, or they may occur on orders for instruments which are to be incorporated into an end product for the Army or Navy. The provision does not mean that any person may make an order an approved order merely by specifying Army or Navy specifications thereon.

In a similar interpretation of order L-272, WPB pointed out that where restrictions are imposed on specifications, and the restrictions include exemptions for the services and similar agencies, manufacturers may not evade unless they are required directly to do so by the agency concerned. Customers may not procure prohibited equipment merely by requiring Army, Navy or Maritime Commission specifications. Only permissible manufacture, delivery or use of such equipment is on an order from one of the services or on an order which will be assembled into end products for one of the services. This interpretation applies to all schedules of L-272.

A third interpretation affects order L-161, which bans the use of copper or copper base alloy in electric fuses except for current-carrying parts. WPB has ruled that the threaded metal exterior end attached to the fibre of a renewal fuse tube and the washer used to hold the fuse link in a renewable fuse are not current-carrying parts and therefore may not be made from copper or copper base alloy.

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Rewinding Data for Direct-Current Armatures. 2nd Edition. By G. A. VanBrunt and A. C. Roe. McGraw-Hill Book Company, New York, N. Y. 277 pages, illustrated. Price $2.50.

Practically half this 1943 edition is new. Seven chapters added, seven rewritten to modernize the treatment to conform to the modernized practice which has evolved on the availability of a fiber glass insulation, of non-oxidizing varnishes and of infra-red drying techniques. The familiar chapters detailing the recognition, layout and rewinding of armatures are retained intact. Again an indispensable reference for the industrial electrical engineer charged with responsibility for upkeep and overhaul of motors.

Introduction to Circuit Analysis. By Abner R. Knight and Gilbert H. Fett. Harper & Brothers, New York, N. Y. 477 pages, illustrated. Price $4.

Having set up the laws of circuits, the treatment then is directed at emphasizing the kinship of electric, magnetic and electrostatic circuits—a commendable effort at wrecking the pedagogical compartments which have made them appear unrelated. There results a unity between such extremes as electronic circuits and polyphase metering circuits which is refreshingly novel. Far from being vocational in flavor the book does, however, stress the importance of analyzing the physical aspects of a practical problem to decide what laws best point to a solution. That in itself should both deter and stimulate the user who has habituated himself to a hunt for quantities to implant into a blind and painless formula. Foundations are laid for flux mapping, vane meters, resonance, network transformations.

Thévenin's substitution, symmetrical components, coupling transients and Fourier coefficients.

Liberty, Employment and No More Wars. T. K. Quinn. Hastings House, New York, N. Y. 241 pages. Price $2.50.

At the risk of being dubbed a capitalist gone soft, the former General Electric "refrigerator" executive pleads with industry to take the reins to achieve employment for all on a stabilized basis. Such elimination of want the world over would, with modest international ordering and policy, likewise achieve "no more mar." He decries rampant individualism, union gangsterism and predatory, exploitive corporations (utilities included), asking responsiveness to social demands so that there will be an end to government by senseless charity. It is admitted that centripetal forces are promoting an almost unescapable centralization, but against further appropriation of business prerogatives the author advocates an "economic senate" of wholly impartial business brains which would anticipate maladjustments. Unrestrained competition is impracticable, trade understandings are imperative to preserve small business and reverse the slaughter of the last four decades. United industry can plan more effectually than government, is the assertion, to regulate minimum levels of income and purchasing power. "A poor man anywhere is an international liability" out of which come wars between the have nots and the haves.

This is the theme of a plea for a self-government of business.

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ELECTRICAL CONSTRUCTION ENGINEER age 52, 30 years experience installation, test and repair, also line construction. Married, good health, and permanent position only considered. Northwest preferred. PW-577, Electrical World, 68 Post St., San Francisco 4, Cal.

ELECTRIC METER MAN years experience in single and polyphase watthour meter work, testing, repairing, installing and switchboard wiring and other meter work, at present in charge of meter department but desire to make a change, would like to locate in southern states for permanent job, age 41, married. PW-580, Electrical World, 330 W. 42nd St., New York 18, N. Y.

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HP	Make	Type	Volts	Speed
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1250	G.E.	MPC	550	130
800	G.E.	MPC	660	600
625	G.E.	MPC	500	130
600	G.E.	MPC	600	650/900
600	Whse.		250	150/275
350	G.E.	MPC	230	450
300	G.E.	DMC	230	400/600
300	Cr. Wh.	CMC	230	1150
300	G.E.	MPC	230	275/550
300	Whse.		500	250/400
250	Al. Ch.		230	525
200	Whse.		230	400
175	Whse.	SK	250	150/525
150	G.E.	RC-19A	230	800/1000
150	Whse.	SK-201	230	300/900
150	G.E.	MPC	230	250/450
125	G.E.	CO-1832	230	625
120	Whse.	SK-180	230	720
100	G.E.	LC-50	230	1200
100	Al. Ch.		230	950/1150
100	G.E.	RC-19	230	575/720
75	G.E.	LC	230	500/1000
75	Whse.	SK	230	475/900
60	El. Dy.	28S	230	525/1050
50/60	Cr. Wh.	65H	230	500/1000
50	G.E.	RC-16	230	650/815

TRANSFORMERS

KVA	Make	PH	Type	Voltages
1667	Pitts	1	OISC	13200x2300
1050	GE	3	WCTH	11000x445
300	G.E.	1	H	13200x2300/575
200	Whse.	1	SK	6900x230/460
200	G.E.	1	H	26400x115/46
100	Whse.	1	OISC	13200x25

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00 HP Whse., 1800/375 RPM.
3 HP GE 5306/1200 RPM.
0 HP DeLaval 3600/600 RPM.

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1—1500 KW GE 600 V. DC, Gen. dc. to 2100 HP—6600 V. Cyn. Motor with exciter.
1—1000 KW G.E. 250 V. DC Gen. dc to 1400 HP—2200/132000 V. Syn. Motor.
1—500 KW GE 600 V. DC Gen. d.c. to 700 HP—2200/13200 V. Syn. Motor with Exciter.
2—250 KW GE 250 V. Gen. d.c. to 375 HP—2200 V. Syn. Motor.

TURBO GENERATOR SET

1—500 KW, Whse. 625 Kva., 440 V., 3 ph., 60 cy., 3600 RPM with Parsons 145/175 lb. condensing turbine complete with jet condenser and accessories.
1—500 KW, G.E., 625 KVA, 2300 V., 3 ph., 60 cy. generator with Curtis 4 stage, 150 pound condensing turbine complete with condenser, etc.

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2—1500 KW, Whse. 720 RPM 650 V. DC with 3-single phase, 33000 V. transformers and panel.
1—1250 KW, G.E., 720 RPM 250 V. DC with 1375 KVA, 3 ph., 2300 V. Transformers and Panels.
2—750 KW, Whse. 1200 RPM, 600 V. DC with 2300/6600/11000 volts Transformers and Panels.
1—750 KW, Whse. 720 RPM 250 V. DC with three phase 6600/2300 V. Transformer and Panels.
1—375 KW, Whse. 1200 RPM 250/275 V. DC with 2200/6600 V. Transformer and Panels.
1—300 KW, G.E., type HCC, 1200 RPM, DC, 600 V. AC 6 ph., 1200 RPM.

25 cycle

3—1500 KW, G.E., 225/275 V. DC Booster type each with 1600 KVA, 3 ph. 6765 volt Transformers and Panels.
1—500 KW, G.E., 225/275 DC Booster type with 500 KVA 3 ph. 6765 volt Transformer and Panels.

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Synchronous

	HP	Make	Type	Volts	Spee
1—	500	G.E.	TS	440	360
1—	250	G.E.	ATI	220	450
1—	225	G.E.	ATI	240	600
1—	200	Whse.		440	514
1—	168	Al. Ch.		2300	900
1—	159	Whse.	G	2400	900
1—	150	Whse.	G	2300	900
1—	150	Whse.		2200/550	1800

Slip Ring

1—	1200	Cr-Wh	801-Q	2200	237
1—	800	Whse	CW	440	357
1—	800	Al. Ch.		440	885
1—	600	G.E.	IM	2200	900
1—	450	Whse.	CW	2200	875
1—	400	G.E.	MT	550/440	300
1—	400	Al. Ch.		2300	505
1—	400	Al. Ch.		440	1200
1—	350	G.E.	IM	2300/4000	257
1—	300	G.E.	IM	2300	585
1—	250	G.E.	MT-410	2300	400
1—	250	G.E.	MT	4000/2300	257

Squirrel Cage

1—	500	G.E.	1-17B	2200	695
1—	400	Whse.	CS-1104A	2200	585
1—	300	Whse.	CS	550	580
2—	300	G.E.	1K	2300	600
1—	250	Al Ch.		220/440	1150

SINE WAVE SET

Main unit—GE 3 unit, 4 Brg. consisting of motor—15/35 HP. 750/1800 RPM. 230 V. DC Gen.—15 KW—220/110 V., 1800 RPM—3 ph., 60 cy.
Ref. Gen.—5 KW—36/18 V., 1800 RPM, 3 ph., 60 cy., with stator shifting
Complete with Exciter Set, Voltage regulator, panels and accessories.

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MOTOR—3 PHASE 60 CYCLE

1—5000 ampere, 6 volt, Hanson-Van Winkle
1—2000 ampere, 6 volt, Hanson-Van Winkle
1—1500 ampere, 6 volt; Hanson-Van Winkle
1—500 HP, 900 RPM, 440 volt, Lincoln slip ring
1—400 HP, 514 RPM, 440 volt, Westg., slip ring
1—335 HP, 600 RPM, 2300 volt, G.E. syn.
1—300 HP, 900 RPM, 440 volt Lincoln slip ring.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—250 HP, 600 RPM, 4000 volt, G.E., sync.
1—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v. G. E., sl. rg.
1—150 HP, 1800 RPM, 2300 volt, Al. Ch. sq. cg.
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
2— 75 HP, 1200 RPM, 2300 volt, G.E., vertical.

MOTORS—D. C. 230 VOLTS

2—450 HP, 400 RPM, General Electric MPL.
1—250 HP, 760 RPM, Electro Dynamic.
2—150 HP, 550 RPM, Westinghouse, SK.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E., 575 RPM.
1—100 HP, 625 RPM, G.E.
1— 65 HP, 1000 RPM, G.E., type RC.
1— 50 HP, RPM, Westinghouse, type SK.

TRANSFORMERS

2—400 KVA, G.E., 4156-240/480 v., Scott taps.
1—300 KVA, Pittsburgh, 7800/440 volts.
1—250 KVA, General Electric 6600/2200/220/440.
2—200 KVA, General Electric 2200/220/440.
1—200 KVA, G.E., 2200-220/440 volts.
1—150 KVA, G.E., 33,000 2300/4000 Y.
2—100 KVA, Westinghouse, 11,430/250 volts.
3—100 KVA, G.E., 2200-220/110 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3— 75 KVA, General Electric 2200/220/440.

MOTORS GENERATOR SETS

1—750 KW, 250 volt, Allis Chalmers, synchronous.
1— 75 KW, 125 volt, Crocker Wheeler, synchronous.
1— 35 KW, 125 volt, Elec. Machinery, sq. cage.

MOTORS—VARIABLE SPEED 230 VOLTS

1—750 KW, 250 volt Allis-Chalmers synchronous.
1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electric Dynamic.
1—60 HP, 600/1200 RPM, General Electric.
1—35 HP, 500/15000 RPM, Westinghouse.
1—35 HP, 350/1050 RPM, Electric Dynamic.
1—30 HP, 225/900 RPM, Crocker Wheeler.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—13/18 HP, 350/1200 RPM, Electro Dynamic
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP,450/1800 RPM, Crocker Wheeler.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—225 KVA, 514 RPM, 600 volt, Westinghouse.
1—200 KVA, 3600 RPM, 240 volt, Allis Chal.
1—62½ KVA, 3600 RPM, 220 volt, Allis Chalmers.

TURBO-GENERATORS

600 KW, terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.

ENGINE GENERATOR SETS

1—150 KVA, General Electric Generator, Ames Uniflow engine.
1—62½ KVA, Westinghouse Generator, Fairbanks Company engine.

Complete Line of A.C. and D.C. Motors and Generators

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1250 KVA 0.8 p.f. 50-deg. rise General Electric, type ATI-10-1250M-300, with amortisseur winding, with 33 KW direct-connected exciter, with
1400 HP 460 volts, 3 phase, 60 cycle,
300 RPM General Electric, 1570 ampere
1250 KVA p.f. 0.9, 50-deg. type ATI-24-1250M-300 form C, with amortisseur winding.

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Acme Electric & Mfg. Co. 138
*Allen-Bradley Co. 19, 20
*Allis-Chalmers Mfg. Co. 10, 11
Aluminum Company of America ... 37
American Bridge Co. 119
American Coach & Body Co. 114
American Cyanamid Company, Plastics Division 35
American Fork & Hoe Co. 135
*American Transformer Co. 13
Anaconda Wire & Cable Co. 83
*Associated Research, Inc. 141
Automatic Alarms Inc. 133
Automatic Switch Co. 131

Barker & Wheeler 140
*Bentley, Harris Mfg. Co. 26
*Biddle Co., James G. 103
Black & Veatch 140
Blaw-Knox Co. 123
*Bright Light Reflector Co. 118
*Bull Dog Electric Products Co. 102
*Burke Electric Co. 16
*Burndy Engineering Co. 31

Cardox Corporation 91
*Chance Company, A. B. 110
Chase-Shawmut Co., The 95
Cheney & Co., E. J. 140
*Clare & Co., C. P. 98
Columbia Engineering Corp. 140
*Connecticut Hard Rubber Co. 136
*Continental-Diamond Fibre Co. 117
Cooper & Co., Inc., Hugh L. 140
*Cope, Inc., T. J. 139
Crescent Insulated Wire & Cable Co. 21

Davis, Julien H. 140
Day & Zimmermann, Inc. 140
Deutschmann Corp., Tobe 45
Directory of Engineers 140

Ebasco Services Inc. 140
Electric Storage Battery Co. 42
*Electrical Engineers Equipment Co. 8
Electrical Testing Laboratories Inc. 97, 140
Elliott Company 6
Engineers, Directory of 140
Everstick Anchor Co. 136

Ferguson, H. F. 140
*Fibre Conduit Co. 120
Foley Construction Corp., Robert E. 140
Ford, Bacon & Davis, Inc. 140
*Four Wheel Drive Auto Co. 99
Fowle & Co., Frank F. 140

*G. C. A. Mfg. Co., The 136
G & W Electric Specialty Co. 12
*General Electric Co. 75, 77, 79, 81
General Electronic Industries, Div. of Auto-Ordnance Corp. 41
Gilbert Associates, Inc. 140
Gould Storage Battery Corp. 87
*Graybar Electric Co. 5
*Greenlee Tool Co. 128
Grinnell Company, Inc. 126

Handy & Harman 137
*Hazard Insulated Wire Works 4
Henkels & McCoy 140
Hoosier Engineering Co. 40, 140
Hubbard & Co. 113

*Imperial Porcelain Works 138
Indiana Steel & Wire Co. 124
*I-T-E Circuit Breaker Co. ... Third Cover

*J-B-T Instruments, Inc. 129

Kelvinator Division of Nash-Kelvinator Corp. 106, 107
Kidde & Co., Inc., Walter 25
*Klein & Sons, Mathias 127
*Krueger & Hudepohl 138
*Kuhlman Electric Co ..... Back Cover

*Lapp Insulator Co. 24
Leffler, William S. 140
Line Material Co. 85

Macallen Company 14
Main, Inc., Chas. T. 140
Mallory & Co., Inc., P. R. 121
Manning & Co., J. H. 140
Matthews Corp., W. N. 135, 137
McGraw-Hill Book Co., Inc. 134
Mead, Daniel W. 140
*Metropolitan Device Corp. Second Cover
*Monitor Controller Co. 36
Mosinee Paper Mills Company 111
Mossman, Inc., Donald P. 139
Mullergren, Arthur L. 140

National Electric Products Corp. ... 46
*National Varnished Products Corp., The 141
*Newport News Shipbuilding & Dry Dock Co. 34

Ohio Brass Co. 9
*Okonite Co. 4
*Okonite-Callender Cable Co. .....
Osmose Wood Preserving Co. of America, Inc. .....
*Owens-Corning Fiberglas Corp. .....

*Pacific Electric Mfg. Corp. .....
Paragon Electric Company .....
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*United States Steel Corp. .....

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*Westinghouse Elec. & Mfg. Co. ... 30, 100, 101,
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PROFESSIONAL SERVICES .....

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SEARCHLIGHT SECTION

(Classified Advertising)

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POSITIONS WANTED .....
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Belyea Co., Inc. .....
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Chicago Electric Co. .....
Ebasco Services, Inc. .....
Electric Service Co., The .....
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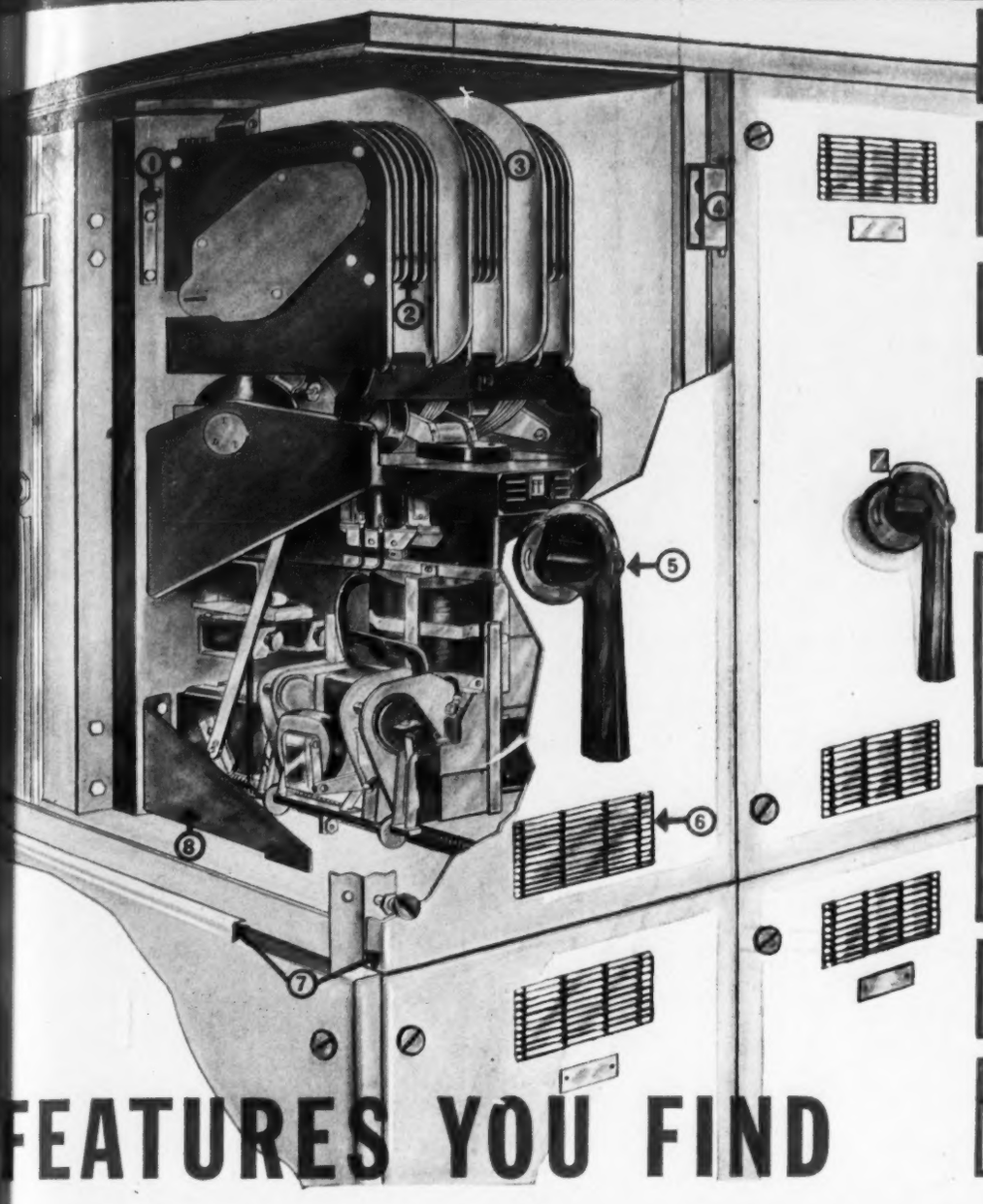
★ **These companies have supplied additional buying information on their products in the 1943 edition of the Electrical Buyers' Reference**



① **LIFTING HOOK**—for ready removal of the circuit breaker for inspection, using overhead crane or portable hoist.

② **ARC CHUTES**—Magnetic blowout construction provides rapid, safe extinction of arcs from short circuits or heavy overloads.

③ **INSULATING BARRIERS**—provide phase insulation additional to that furnished by arc chutes.

④ **HINGES**—To permit ready drawout of circuit breaker for inspection, hinges allow door to open 100 degrees. They are invisible when door is closed and are slotted to permit individual alignment and adjustment of the door.

⑤ **ROTARY DOOR HANDLE**—attached to hinged door, provides both closing and tripping. Disengages automatically from circuit breaker when door is opened. Thumb-operated locking plate in the top can be raised when handle is in trip position to hold up to three padlocks for protection of workmen against energizing of line before clearance is given.

⑥ **GRILLE-TYPE LOUVERS**—at top and bottom of each door, provide ample air circulation, dissipating heat from series coils. Baffle design helps in keeping out dust.

⑦ **FLANGED DOORS AND PANELS**—make rigid, non-warping members without use of needlessly heavy-gauge sheet.

⑧ **BASE FOOT**—makes the circuit breaker a self-standing unit when removed from compartment and placed on floor or inspection bench.

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As a method of clearly showing hidden parts, the I-T-E Engineering Department offers this perspective cut-away drawing which has advantages over either photographic or the usual mechanical treatment. We plan a series of these to make the clearest possible explanation of Multumite advantages.

Multumite switchgear assemblies are completely metal-enclosed structures in which I-T-E incorporates many features, including those above, for safety and convenience in control and distribution of electric power.

Write for Bulletin 4207—a thorough description of I-T-E Multumite drawout switchgear.

I-T-E

AIR SWITCHGEAR

IMMERSED IN AIR • ENCASED IN STEEL

Representatives in Principal Cities

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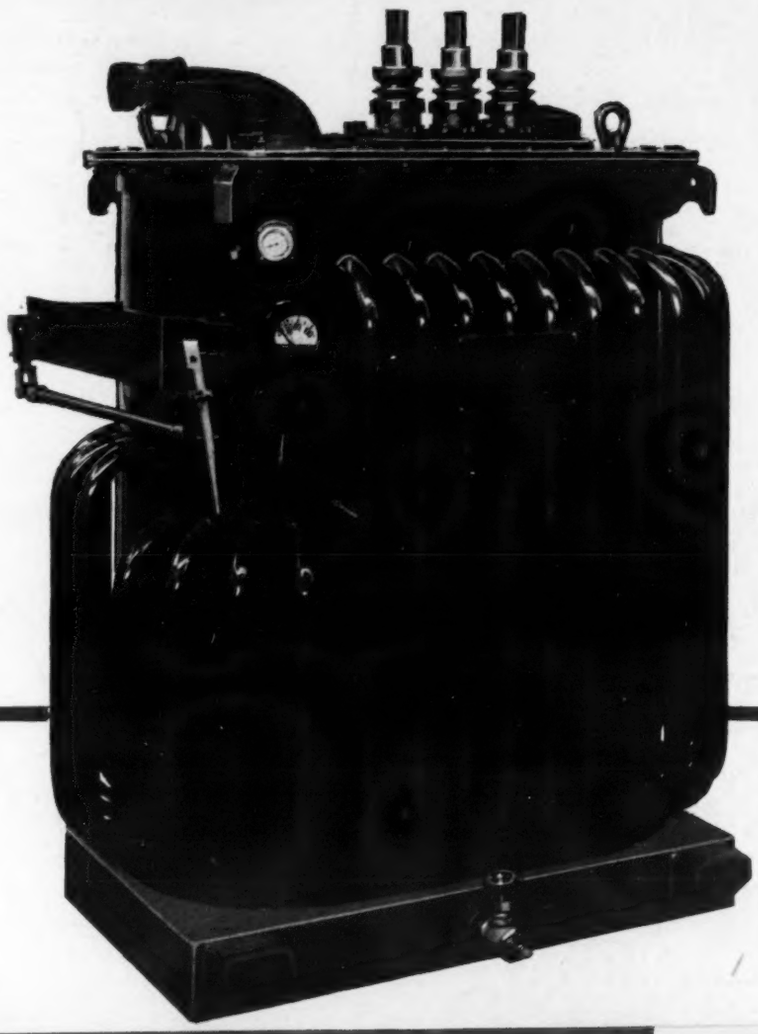

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